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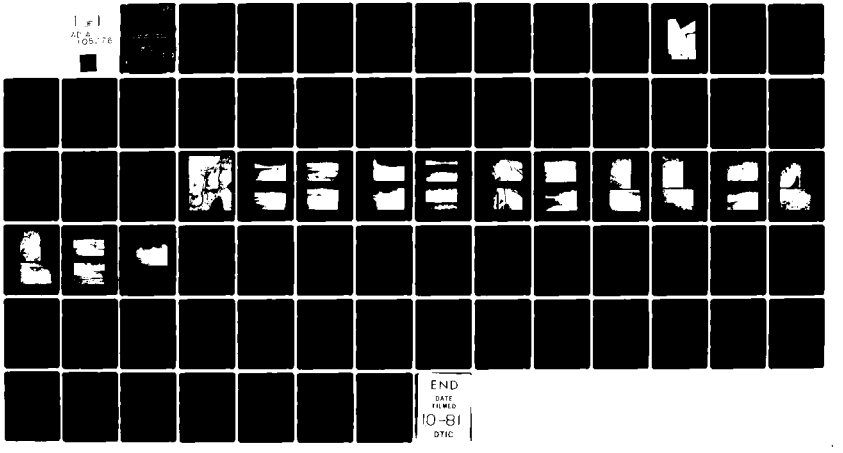

LEVEL II

MISSOURI - KANSAS CITY BASIN

AD A105276

WILDERNESS CAMP DAM

RAY COUNTY, MISSOURI

MO. 11221

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

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PREPARED BY: U.S. ARMY ENGINEER DISTRICT, ST. LOUIS

FOR: STATE OF MISSOURI

JULY, 1980

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report was prepared under the National Program of Inspection of Non-Federal Dams. This report assesses the general condition of the dam with respect to safety, based on available data and on visual inspection, to determine if the dam poses hazards to human life or property.

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

WILDERNESS CAMP DAM
RAY COUNTY, MISSOURI
MISSOURI INVENTORY NO. MO 11221

PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

PREPARED BY
HOSKINS-WESTERN-SONDEREGGER, INC.
CONSULTING ENGINEERS
LINCOLN, NEBRASKA

UNDER DIRECTION OF

ST. LOUIS DISTRICT, CORPS OF ENGINEERS

FOR

GOVERNOR OF MISSOURI

JULY, 1980

DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
210 TUCKER BOULEVARD, NORTH
ST. LOUIS, MISSOURI 63101

REPLY TO ATTENTION OF

LMSED-PD

SUBJECT: Wilderness Camp Dam (MO 11221) Phase I Inspection Report

This report presents the results of field inspection and evaluation of the Wilderness Camp Dam (MO 11221).

It was prepared under the National Program of Inspection of Non-Federal Dams.

This dam has been classified as unsafe, emergency by the St. Louis District as a result of the application of the following criteria:

a. Spillway will not pass a 10% Probability Flood (10-year) frequency flood without overtopping of the dam. The spillway is, therefore, considered to be unusually small and seriously inadequate.

b. Overtopping could result in failure of the dam.

c. Dam failure significantly increases the hazard to life and property downstream.

SUBMITTED BY: SIGNED — 1 DEC 1980

Chief, Engineering Division — Date

APPROVED BY: — 1 DEC 1980

Colonel, CE, District Engineer — Date

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

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PHASE I REPORT
NATIONAL DAM SAFETY PROGRAM
ASSESSMENT SUMMARY

Name of Dam	Wilderness Camp Dam
State Located	Missouri
County Located	Ray County
Stream	Tributary to Coon Branch
Date of Inspection	July 2, 1980

Wilderness Camp Dam was inspected by an interdisciplinary team of engineers from Hoskins-Western-Sonderegger, Inc. The purpose of the inspection was to make an assessment of the general conditions of the dam with respect to safety, based upon available data and visual inspection, in order to determine if the dam poses hazards to human life or property.

The guidelines used in the assessment were furnished by the Department of the Army, Office of the Chief of Engineers and developed with the help of several Federal and State agencies, professional engineering organizations, and private engineers.

Wilderness Camp Dam has a height of twenty-five (25) feet and a storage capacity at the minimum top elevation of the dam of one hundred-fifty (150) acre-feet. In accordance with the guidelines, a small size dam has a height greater than or equal to twenty-five (25) feet but less than forty (40) feet and a storage capacity greater than or equal to fifty (50) acre-feet but less than one thousand (1,000) acre-feet. The size classification is determined by either the storage capacity or height, whichever gives the larger size category. Wilderness Camp Dam is classified as a small size dam.

In accordance with the guidelines and based on visual observation, the dam is classified as having a high potential for damage and loss of life. Failure would threaten life and property. The estimated damage zone extends approximately two (2) miles downstream of the dam. Within the damage zone are one dwelling (0.2 mile downstream), one dwelling and three outbuildings (0.5 mile downstream), one house trailer (0.7 mile downstream) and Highway D (2.0 miles downstream).

Our inspection and evaluation indicate that the spillways do not meet the minimum criteria set forth in the recommended guidelines for a small dam having a high hazard potential. In consideration of the small volume of water impounded and the size of the downstream floodplain 50 percent of the Probable Maximum Flood is the appropriate spillway design flood. The spillways will not pass the 10-year flood (a flood having a 10 percent probability of being exceeded in any year) without overtopping the dam. The spillways will pass 13 percent of the Probable Maximum Flood without overtopping the dam. The Probable Maximum Flood (PMF) is defined as the flood that may be expected from the most severe combination of critical

meteorologic and hydrologic conditions that are reasonably possible in the region.

No design data were available for this dam. Based on the field inspection of the dam the following remedial measure should be implemented by the owner on a high priority basis:

a. The spillway size and/or the height of dam should be increased to pass 50 percent of the probable maximum flood without overtopping the dam. Spillway design should include erosion controls in order to prevent the headcutting that is occurring in the existing emergency spillway.

The following operation and maintenance procedures are recommended and should be implemented by the owner in the near future:

a. Seepage and stability analyses comparable to the recommendations of the recommended guidelines should be performed by an engineer experienced in the design and construction of dams.

b. The bracing supports for the anti-vortex fin on the inlet of the principal spillway should be repaired.

c. The tie-down strap on the principal spillway outlet pipe should be bolted down and measures taken to prevent recurrence of this deficiency.

d. The gully in the emergency spillway outlet channel should be repaired and stabilized. Measures should be taken to prevent surface drainage into the emergency spillway by improving the adjacent road drainage diverting the runoff or other means.

e. A program of regular maintenance and inspection should be initiated. Inspection should include the monitoring of beaver activity around the spillways, erosion in the emergency spillway and physical conditions of the pipe spillway. Records of inspections and maintenance operations should be made a part of this project site.

Rey S. Decker
E-3703

Gordon Jamison

Harold Ulmer
Garold Ulmer
E-19246

H. P. Hoskins
Harold P. Hoskins, Chairman of the Board
Hoskins-Western-Sonderegger, Inc.
E-8696

PHOTO NO. 1 - OVERVIEW

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
WILDERNESS CAMP DAM - MO 11221
RAY COUNTY, MISSOURI

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

a. Authority. The National Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army through the Corps of Engineers, to initiate a program of safety inspection of dams throughout the United States. Pursuant to the above, the St. Louis District, Corps of Engineers, District Engineer directed that a safety inspection of Wilderness Camp Dam be made.

b. Purpose of Inspection. The purpose of the inspection was to make an assessment of the general condition of the dam with respect to safety, based upon available data and visual inspection, in order to determine if the dam poses hazards to human life or property.

c. Evaluation Criteria. Criteria used to evaluate the dam were furnished by the Depratment of the Army, Office of the Chief of Engineers, in "Recommended Guidelines for Safety Inspection of Dams", Appendix D to "Report of the Chief of Engineers on the National Program of Inspection of Dams," dated May, 1975, and published by the Department of the Army, Office of the Chief of Engineers.

1.2 DESCRIPTION OF PROJECT

a. Description of Dam and Appurtenances.

(1) The dam is an earthfill approximately 400 feet in length and 25 feet in height. The maximum water storage at the minimum top elevation of the dam is 150 acre-feet. The dam is located in the gently rolling hill country of the Central Lowlands Physiographic Area in the northeast corner of Ray County.

(2) The principal spillway consists of a 5-foot diameter welded steel riser connected to a 3-foot diameter welded steel conduit which extends through the embankment.

(3) A vegetated earth emergency spillway is cut through the loess on the right abutment. It has a bottom width of about 30 feet.

(4) Pertinent physical data are given in paragraph 1.3 below.

b. Location. The dam is located in the northeast corner of Ray County about 4 miles southeast of Elmira, MO. Plate A-1 shows it located in the NW 1/4, Sec. 26, T54N, R29W.

c. Size Classification. Wilderness Camp Dam has a height of 25 feet and a storage capacity of 150 acre-feet. This dam is classified as a small size dam. A small size dam has a height greater than or equal to 25 feet but less than 40 feet and a storage capacity greater than or equal to 50 acre-feet but less than 1,000 acre-feet. The size classification is determined by either the storage or height, whichever gives the larger size category.

d. Hazard Classification. Guidelines for determining hazard classification are presented in the same guidelines as referenced in paragraph 1.1c above. Based on referenced guidelines and visual observation Wilderness Camp Dam is in the High Hazard Potential Classification. The estimated damage zone extends approximately two miles downstream of the dam. Within the damage zone are one dwelling (0.2 mile downstream), one dwelling and three outbuildings (0.5 mile downstream), one house trailer (0.7 mile downstream) and Highway D (2.0 miles downstream).

e. Ownership. The dam is owned by Methodist Camps, Inc., 1512 Van Brundt, Kansas City, MO. 64127 Attention: Dr. Fritz Mutti, Director of Camping.

f. Purpose of Dam. The dam impounds a recreational lake covering about 9 surface acres.

g. Design and Construction History. Mr. Wayne Cleveland, caretaker of the camp, reported that the dam was constructed about 1971 by Wray Russel of Excelsior Springs, Missouri. No other information was available on design or construction of the dam.

h. Normal Operating Procedures. There are no controlled outlets for this dam. The pool level is controlled by rainfall, infiltration, evaporation and the capacity of the uncontrolled spillways.

1.3 PERTINENT DATA

a. Drainage Area. 557 acres (0.87 square miles).

b. Discharge at Damsite.

(1) All discharges at the damsite are through the following:

(a) An uncontrolled principal spillway consisting of a 5-foot diameter welded steel pipe riser connected to a 3-foot diameter welded steel pipe conduit which extends through the embankment.

(b) An uncontrolled vegetated earth emergency spillway with a crest width of approximately 30 feet and length of approximately 25 feet.

(2) Estimated maximum flood at damsite - Water surface elevation reached the emergency spillway crest elevation during a time when the principal spillway was blocked because of beaver activity.

(3) The principal spillway capacity varies from 0 c.f.s. at elevation 893.6 feet to 82 c.f.s. at the crest of the emergency spillway (elevation 897.2 feet) to 97 c.f.s. at the minimum top of dam (elevation 899.5 feet).

(4) The emergency spillway capacity varies from 0 c.f.s. at its crest (elevation 897.2 feet) to 300 c.f.s. at the minimum top of dam (elevation 899.5 feet).

(5) Total spillway capacity at the minimum top of dam is 400 c.f.s. ±.

c. Elevations (feet above M.S.L.).

(1) Observed pool - 893.1

(2) Normal pool - 893.6

(3) Spillway crest (s)

Principal - 893.6

Emergency - 897.2

(4) Maximum experienced pool - 897.5 ± (1979)

(5) Top of dam (minimum) - 899.5

(6) Maximum Tailwater - Unknown

(7) Streambed at Centerline - 865

d. Reservoir.

(1) Length (feet) of pool at top of dam - 2,000 ±

(2) Length (feet) of pool at principal spillway crest - 1,300 ±

(3) Length (feet) of pool at emergency spillway crest - 1,500 ±

e. Storage (Acre-feet).

(1) Observed pool - 76 ±

(2) Normal pool - 80 ±

(3) Spillway crest (s)

Principal - 80 ±

Emergency - 118 ±

(4) Maximum experienced pool - 122 ±

(5) Top of dam (minimum) - 150 ±

f. Reservoir Surface (Acres).

(1) Observed pool - 8.7 ±

(2) Normal pool - 9.2 ±

(3) Spillway crest (s).

Principal - 9.2 ±

Emergency - 12.5 ±

(4) Maximum experienced pool - I3 ±

(5) Top of dam (minimum) - 14.5 ±

g. Dam.

(1) Type - Earth fill

(2) Length - 400 feet ±

(3) Height - 25 feet ±

(4) Top width - 20 feet ±

(5) Side slopes.

(a) Downstream 1V on 3.2H (measured)

(b) Upstream 1V on 3.4H (measured on exposed slope)

(6) Zoning - Unknown

(7) Impervious core - Unknown

(8) Cutoff - Unknown

(9) Grout curtain - Unknown

(10) Wave protection - Vegetation

(11) Drains - None observed

h. Diversion Channel and Regulating Tunnel. None

i. Spillway.

(1) Principal

(a) Type - Uncontrolled, 5-foot diameter welded steel pipe riser 4.8 feet high connected to a 3-foot diameter welded steel pipe conduit. Riser is equipped with anti-vortex device.

(b) Crest (invert) elevation - 893.6 feet ±

Outlet - 866.9 feet ±

(c) Length - 164 feet

(2) Emergency

(a) Type - Vegetated earth, uncontrolled, cut through the right abutment. The bottom width is 30 feet ±.

(b) Control section. Level section about 25 feet in length near the centerline of the dam.

(c) Crest elevation - 897.2 feet ±

(d) Upstream channel - Open and well vegetated on about 8% grade from control section to reservoir.

(e) Downstream channel - Open and vegetated on variable grade of 1.5 to 4.3 +%.

j. Regulating Outlets. None

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

No design data were available for this dam.

2.2 CONSTRUCTION

No construction data were available. It was reported by Mr. Cleveland that the dam was constructed in about 1971 by Wray Russell of Excelsior Springs, Missouri.

2.3 OPERATION

No data were available on spillway operation. It was reported by Mr. Cleveland that the emergency spillway has operated twice since 1973. In 1979 the reservoir level exceeded the crest of the spillway. This resulted from beavers plugging the principal spillway inlet. A well pronounced high water mark was observed on the upstream slope during the inspection. The elevation of this mark was 897.5 or 0.3 of a foot above the crest of the emergency spillway and 2.0 feet below the minimum crest elevation of the dam. There was no evidence to indicate that the dam has been overtopped.

2.4 EVALUATION

a. Availability. No data were available.

b. Adequacy. The field surveys and visual observation presented herein are considered adequate to support the conclusions of this report. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency. These seepage and stability analyses should be performed for appropriate loading conditions (including earthquake loads) and made a matter of record.

c. Validity. Not applicable.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

a. General. A visual inspection of the Wilderness Camp Dam was made on July 2, 1980. Engineers from Hoskins-Western-Sonderegger, Inc., Lincoln, Nebraska making the inspection were: R. S. Decker, Geotechnical; Garold Ulmer and Gordon Jamison, Hydrology and Hydraulics. Mr. Wayne Cleveland, camp caretaker, met with the inspection team at the dam.

b. Dam.

(1) Geology and Soils (abutment and embankment). The dam is located in the Central Lowlands Physiographic Region where 8 to 10 feet of loess overlies Kansan till or bedrock which consists of shale, limestone or sandstone of the Kansas City Group, Missouri Series, Pennsylvanian System. Upland soils are derived from loess and/or till and are mapped in the Sharpsburg-Grundy-Adair-Shelby Soil Association. Materials in the embankment are generally CL's. Limestone bedrock is exposed in both abutments of the dam (Photo 13) and interstratified limestone and shales are exposed in the stream channel and the outlet of the emergency spillway (Photos 17 and 23). Materials in the embankment are generally CL's. Alluvium in the valley section is shallow CL-ML over bedrock. No glacial till was observed at this site. No evidence of solution activity was observed at the dam site.

(2) Upstream Slope. The upstream slope is well vegetated with grass above the normal pool level. No significant erosion was noted on the upstream slope, and no slides, slumps or deformations were observed. Photo No. 4 shows the upstream slope.

(3) Crest. The crest is well vegetated with adapted grasses. Measurements indicate that the crest elevation is very uniform except for a low swag on the left end. Plate C-1 shows the profile along the centerline of the dam. No cracks or abnormal deformations were noted on the crest. The low swag toward the left end did not appear to result from excessive settlement or deformation of the embankment. Photo 3 and 4 show the crest.

(4) Downstream Slope. The downstream slope is very well vegetated with adapted grasses. No slumps, slides or deformations were observed. No rodent activity was noted on the downstream slope; however, beavers are active in the reservoir, as noted later in this report. Photo No. 5 shows the downstream slope. Some erosion was noted near the junction of the downstream toe and the spillway pipe conduit as shown in Photo No. 19.

A small gully was observed at the lower end of the right abutment trough. This gully extends up the trough to an elevation of about 878 and is shown in Photo 22. Seepage was observed along the toe from about station 2+50 to the spillway pipe at about station 3+00. All seep was clear and ponded along the toe. This seep area, to the left of the spillway pipe, is shown in Photos 14, 15 and 16. Discharge (near the spillway pipe) from the seep along the toe is estimated at 0.1 to 0.2 g.p.m. and is shown in Photo 21. Seepage was also noted in the gully at the lower end of the emergency spillway outlet. Seepage in the spillway gully and along both sides of and into the pipe spillway scour hole appears to outcrop at the interface of the shale and underlying limestone. Seepage discharge into the scour hole and old stream channel is estimated to be less than 1 g.p.m. Photos 17 and 18 show seepage into the scour hole and channel.

c. Appurtenant Structures.

(1) The principal spillway is uncontrolled and consists of a welded steel pipe riser, 5 feet in diameter and 4.8 feet high, connected to a welded steel pipe conduit 3 feet in diameter. No significant deterioration was noted in the riser pipe; however, most of the steel rod braces for the anti-vortex device are disconnected. The riser and steel braces are shown in Photos 8, 10 and 11. No deterioration was observed in the outlet end of the conduit, as shown in Photos 18 and 19. The tie-down strap around the spillway pipe, located about 12 feet upstream from the outlet end, is loose on the left side. This is shown in Photo No. 20.

(2) The emergency spillway is uncontrolled and consists of a channel excavated through the right abutment. The entrance, control, and exit sections are well vegetated with adapted grasses. No erosion was noted in these sections as shown in Photos 6 and 7. No slumps or slides were observed. A gully and head cut is progressing up the right side of the spillway outlet channel. This gully has cut to shale and limestone at the lower end. The gully is shown in Photo No. 23. Mr. Cleveland reported that most of this erosion in the emergency spillway outlet results from uncontrolled runoff from the steep right abutment and road bordering the right side of the dam and reservoir. Attempts to control the erosion have been made by placing logs, stumps and other trash in the gully.

(3) Drawdown facilities. There are no drawdown facilities for this dam.

d. Reservoir Area . The area around the reservoir waterline is well grassed or consists of limestone outcrops. No significant erosion was noted. No slumps or slides were observed around the reservoir. There was no evidence of heavy siltation in the reservoir. Photos 8 and 13 show portions of the reservoir and shoreline.

e. Downstream Channel. The stream channel downstream from the principal spillway is cut into limestone. It is fairly open and is stable. As previously noted, seepage discharges along both sides of the channel for a considerable distance downstream from the dam. This seepage appears to discharge at the interface of shale and limestone. Photo No. 17 shows the section of channel just downstream from the principal spillway.

3.2 EVALUATION

This dam appears to be in good structural condition with little potential of failure. Seepage along the toe of the dam apparently results from the proximity of bedrock under the dam and does not appear to impair the integrity of the dam. No evidence of solution cavitation was observed at the dam site. The area is not noted as a geologic setting subject to catastrophic sinkhole collapse. Erosion in the emergency spillway outlet channel could ultimately breach the reservoir if left uncontrolled. Minor deficiencies in maintenance of the principal spillway should be corrected.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

There are no controlled outlet works for this dam. The pool level is controlled by rainfall, infiltration, evaporation, and the capacity of the uncontrolled spillways.

4.2 MAINTENANCE OF DAM

Maintenance appears to be reasonably good. Attempts have been made to control erosion in the spillway channel. Maintenance of the principal spillway has been neglected.

4.3 MAINTENANCE OF OPERATING FACILITIES

No operating facilities exist at this dam.

4.4 DESCRIPTION OF ANY WARNING SYSTEM IN EFFECT

There is no warning system in effect for this dam.

4.5 EVALUATION

An improvement in maintenance procedures should be made especially in regard to repairs to the principal spillway and to control of erosion in the emergency spillway channel.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES

a. Design Data. No design data were found for this dam.

b. Experience Data. The drainage area, reservoir surface area, and elevation-storage data were developed from the USGS Lawson, Missouri 7 1/2 minute topographic quadrangle map. The hydraulic computations for the spillway and dam overtopping discharge ratings were based on data collected in the field at the time of the field inspection.

c. Visual Observations.

(1) The welded-steel pipe principal spillway riser and conduit appeared to be in excellent condition at the entrance. However, most of the braces on the anti-vortex fin have broken at the weld to the riser. These should be repaired immediately to prevent clogging.

(2) The emergency spillway channel and crest have a good grass cover with no signs of erosion. There is a headcut forming approximately 100 feet downstream from the crest. According to the camp caretaker, Mr. Cleveland, the erosion is caused by hillside runoff and not flow through the spillway.

(3) The upper 2 to 2 1/2 feet of the upstream slope is well vegetated. Below that level there is heavy weed growth and water grass. There is no riprap on the upstream slope. The crest is well vegetated, and there are no signs of cracks or potholes. The downstream slope is also well vegetated. Some erosion is evident where the conduit first becomes exposed.

(4) One side of a tie-down strap on the conduit pipe is broken loose from the anchor bolt (See Photo No. 20). This is probably evidence of severe vibration and should be repaired as soon as possible. The strap is approximately 12 feet upstream from the end of the conduit pipe.

d. Overtopping Potential. The spillways are too small to pass 50% of the probable maximum flood without overtopping. The spillways will pass 13 percent of the probable maximum flood without overtopping. The spillways will not adequately pass the 10 percent probability flood. Overtopping is dangerous because the flow of water over the crest will erode the face of the dam and, if continued long enough, will breach the dam with sudden release of all of the impounded water into the downstream floodplain.

The results of the routings through the dam are tabulated in regards to the following conditions:

Frequency	Inflow Discharge c.f.s.	Outflow Discharge c.f.s.	Maximum Pool Elevation	* Maximum Depth Over Top Feet	Duration Over Top Hours
10%	1,330	450	899.7	0.2	1
1/2 PMF	3,660	3,530	901.4	1.9	6
PMF	7,320	7,110	902.5	3.0	8
0.13 PMF	830	400	899.5	---	---

* Minimum Top of Dam Elevation - 899.5

According to the recommended guidelines from the Department of the Army, Office of the Chief of Engineers, this dam is classified as having a high hazard rating and a small size. Therefore, the 1/2 PMF to PMF is the test for the adequacy of the dam and its spillway.

The estimated damage zone is described in Paragraph 1.2d in this report.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observation. The dam appears to be structurally stable. There were no signs of distress or deformation. Factors of safety against shear failures should be adequate for a dam of this height, even without toe drains, considering the good materials in the dam and the relatively flat side slopes. All seepage was clear without evidence of any boils.

b. Design and Construction Data. No design or construction data were available. Seepage and stability analysis comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency.

c. Operating Records. There are no controlled operating facilities for this dam.

d. Post Construction Changes. None

e. Seismic Stability. This dam is located in Seismic Zone 1. An earthquake of the magnitude predicted in this area is not expected to cause structural failure of this dam.

SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Safety. The effects of foundation seepage on the structural stability of this dam are unknown, but it would appear that they are not significant. The dam is considered to be structurally stable with no visible signs of distress. The spillway capacity of the dam is seriously inadequate. The spillways will pass only 13 percent of the probable maximum flood and will not pass the 10 percent probability flood without overtopping the dam. Overtopping is dangerous because the flow of water over the crest will erode the face of the dam and, if continued long enough, will breach the dam with sudden release of all of the impounded water into the downstream floodplain. The erosion occurring in the emergency spillway channel, if left uncontrolled, could ultimately result in breaching of the reservoir. Minor repairs should be made to the steel rod braces of the anti-vortex device and to the tie-down strap of the principal spillway pipe. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency.

b. Adequacy of Information. Due to the lack of engineering data, the conclusions in this report are based upon performance history and visual observations. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency.

c. Urgency. The measures recommended in paragraph 7.2b should be accomplished in the near future. The item recommended in paragraph 7.2a should be pursued on a high priority basis.

d. Necessity for Further Investigations. The additional studies and analyses recommended in paragraph 7.2a should be accomplished by the owner in the near future.

e. Seismic Stability. This dam is located in Seismic Zone 1. An earthquake of this magnitude is not expected to be hazardous to this dam. It is recommended, however, that the prescribed seismic loading for Seismic Zone 1 be applied in any stability analyses performed for this dam.

7.2 REMEDIAL MEASURES

The following remedial measures and maintenance procedures are recommended. All remedial measures should be performed under the guidance of a registered professional engineer experienced in the design and construction of earth dams.

a. Alternatives.

(1) The spillway size and/or the height of dam should be increased to pass 50 percent of the probable maximum flood without overtopping the dam. Spillway design should include erosion controls in order to prevent the headcutting that is occurring in the existing emergency spillway.

b. Operation and Maintenance Procedures.

(1) Seepage and stability analyses comparable to the requirements of the recommended guidelines should be performed by an engineer experienced in the design and construction of dams.

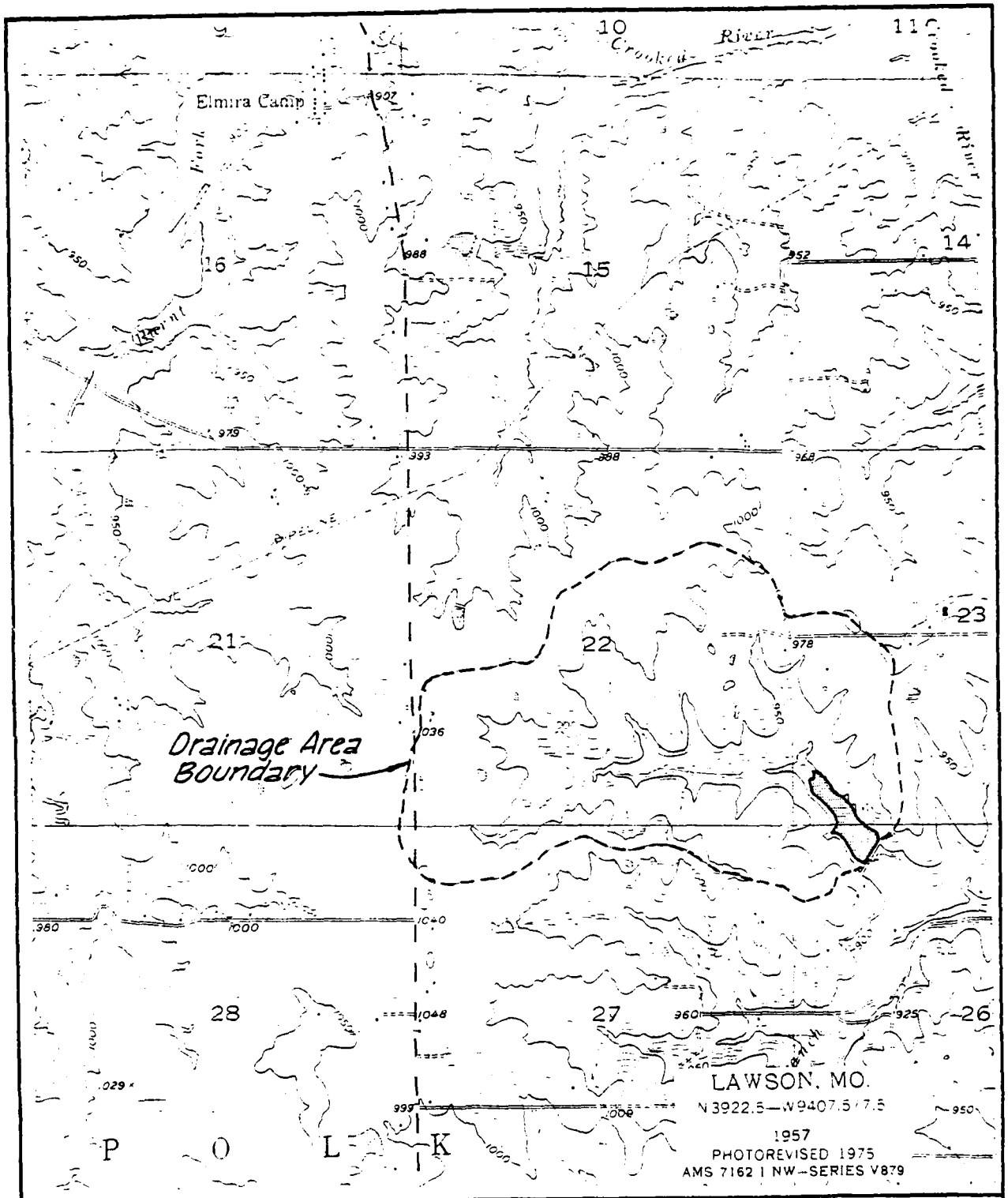
(2) The bracing supports for the anti-vortex fin on the inlet of the principal spillway should be repaired.

(3) The tie-down strap on the principal spillway outlet pipe should be bolted down and measures taken to prevent recurrence of this deficiency.

(4) The gully in the emergency spillway outlet channel should be repaired and stabilized. Measures should be taken to prevent surface drainage into the emergency spillway by improving the adjacent road drainage, diverting the runoff or other means.

(5) A program of regular maintenance and inspection should be initiated. Inspection should include the monitoring of beaver activity around the spillways, erosion in the emergency spillway and physical conditions of the pipe spillway. Records of inspections and maintenance operations should be made a part of this project file.

APPENDIX A
MAPS



Scale in feet

2000 1000 0 2000 4000

Contour Interval – 10'

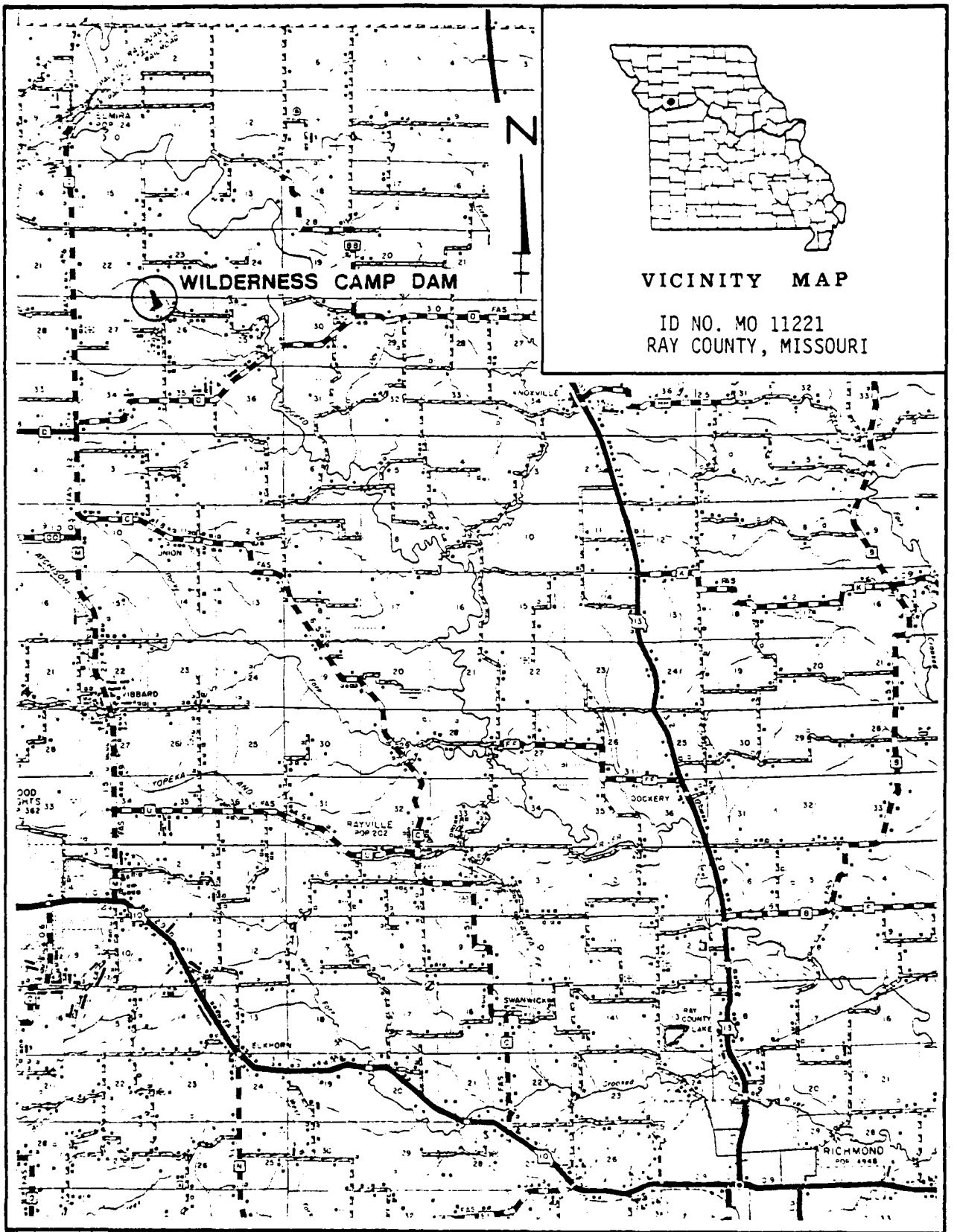
N

VICINITY TOPOGRAPHY

WILDERNESS CAMP DAM

RAY COUNTY, MISSOURI

MO. 11221 PLATE A-1



LOCATION MAP

PLATE A-2

APPENDIX B
PHOTOGRAPHS

WILDERNESS CAMP DAM
RAY COUNTY, MISSOURI
MO 11221

PHOTO INDEX

PLATE B-1

PHOTO NO. 2 - OVERVIEW FROM RIGHT UPSTREAM BANK

PHOTO NO. 3 - CREST TAKEN FROM RIGHT END

PHOTO NO. 4 - UPSTREAM SLOPE FROM RIGHT END

PHOTO NO. 5 - DOWNSTREAM SLOPE FROM RIGHT END

PHOTO NO. 6 - VIEW UPSTREAM IN EMERGENCY SPILLWAY

PHOTO NO. 7 - VIEW DOWNSTREAM IN EMERGENCY SPILLWAY

PHOTO NO. 8 - VIEW UPSTREAM OVER TOP OF PRINCIPAL SPILLWAY INLET RISER

PHOTO NO. 9 - VIEW DOWNSTREAM AT PRINCIPAL SPILLWAY OUTLET PIPE

PHOTO NO. 10 - VIEW UPSTREAM LOOKING INTO PRINCIPAL SPILLWAY INLET RISER

PHOTO NO. 11 - VIEW DOWNSTREAM LOOKING INTO PRINCIPAL SPILLWAY INLET RISER

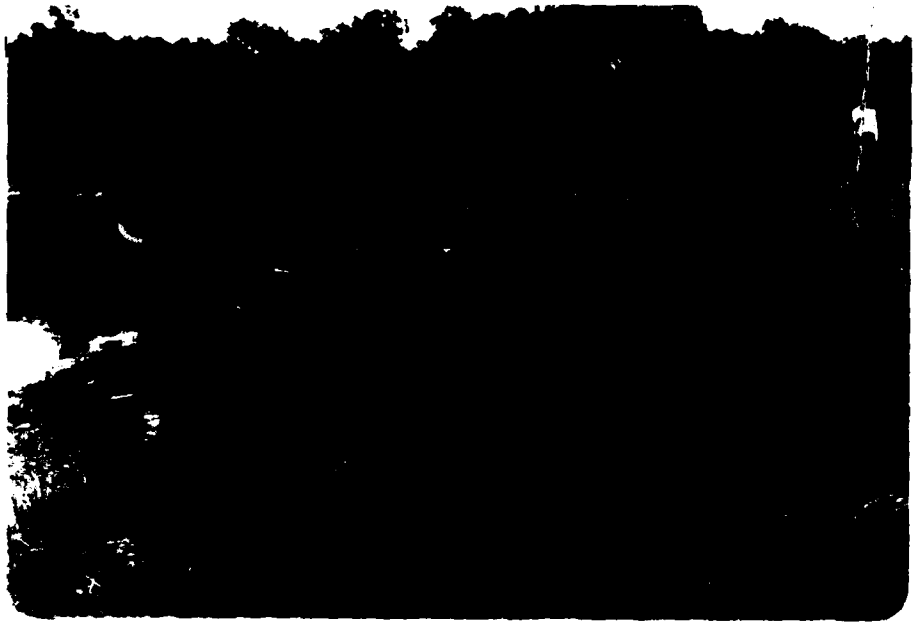


PHOTO NO. 12 - VIEW OF UPSTREAM SLOPE FROM PRINCIPAL SPILLWAY RISER WITH LEFT ABUTMENT IN BACKGROUND

PHOTO NO. 13 - VIEW OF LEFT UPSTREAM BANK SHOWING EXPOSED LIMESTONE OUTCROPS

PHOTO NO. 14 - SEEP NEAR TOE OF DAM LEFT OF SPILLWAY PIPE

PHOTO NO. 15 - SEEP AREA ALONG TOE OF DAM TO THE LEFT OF THE PRINCIPAL SPILLWAY OUTLET. TALL GRASS IN FOREGROUND IS BEGINNING OF SEEP LOOKING LEFT TO RIGHT

PHOTO NO. 16 - SEEP AREA ALONG TOE OF DAM TO THE LEFT OF THE PRINCIPAL SPILLWAY OUTLET

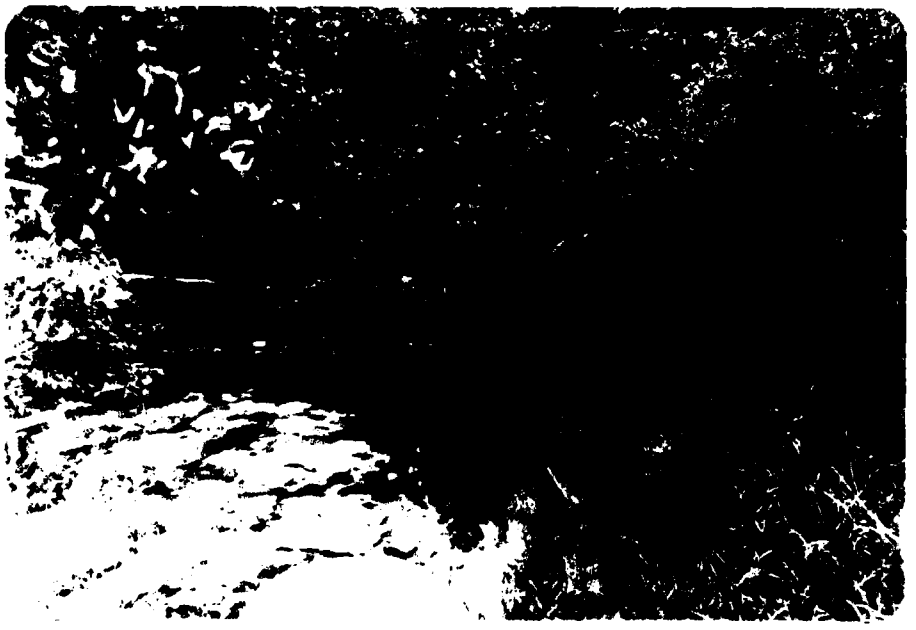


PHOTO NO. 17 - VIEW OF CHANNEL DOWNSTREAM OF PRINCIPAL SPILLWAY OUTLET

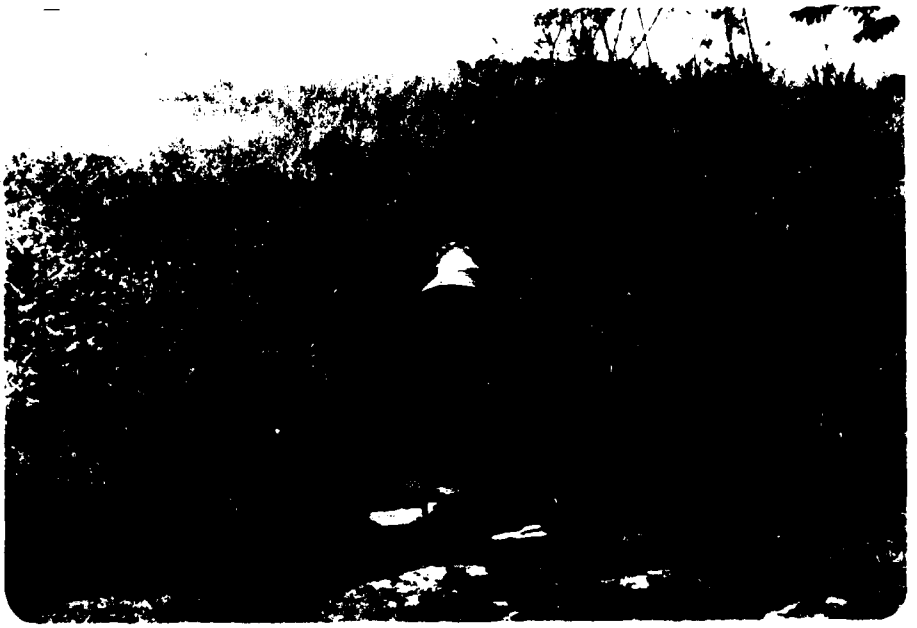


PHOTO NO. 18 - DOWNSTREAM END OF PRINCIPAL SPILLWAY PIPE OUTLET

PHOTO NO. 19 - VIEW UPSTREAM ALONG OUTLET PIPE SHOWING JUNCTION OF THE FILL AND THE PIPE

PHOTO NO. 20 - VIEW UPSTREAM ALONG OUTLET PIPE SHOWING LOOSE TIE DOWN STRAP

PHOTO NO. 21 - SEEPAGE FLOWING OUT OF SEEPAGE AREA BELOW OUTLET PIPE

PHOTO NO. 22 - VIEW LOOKING UPSTREAM INTO EROSIONAL GULLY IN RIGHT ABUTMENT TROUGH

PHOTO NO. 23 - VIEW LOOKING UPSTREAM INTO GULLY AND HEADCUT IN EMERGENCY SPILLWAY EXIT CHANNEL

PHOTO NO. 24 - DOWNSTREAM HAZARD ON LEFT BANK APPROXIMATELY ONE HALF MILE DOWNSTREAM

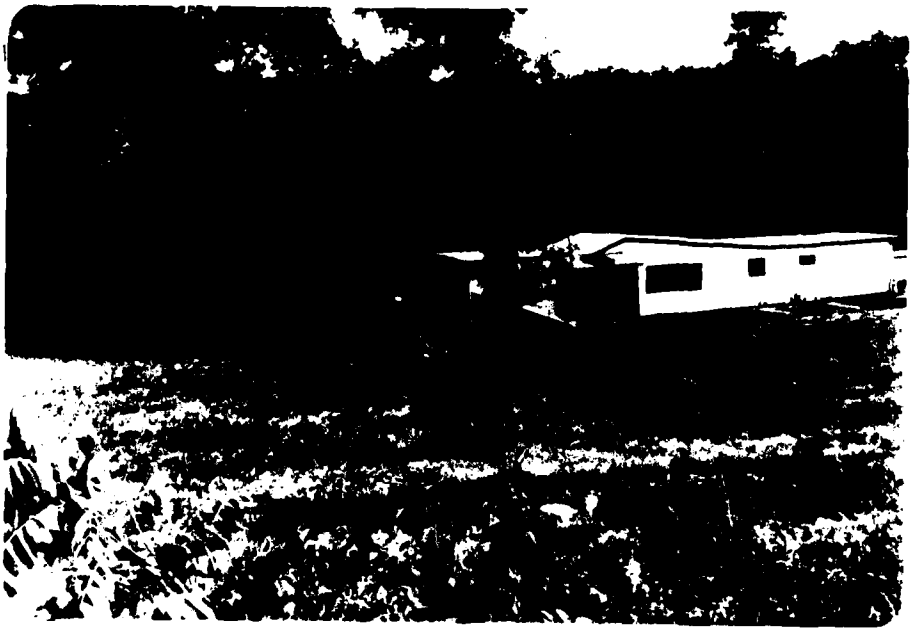
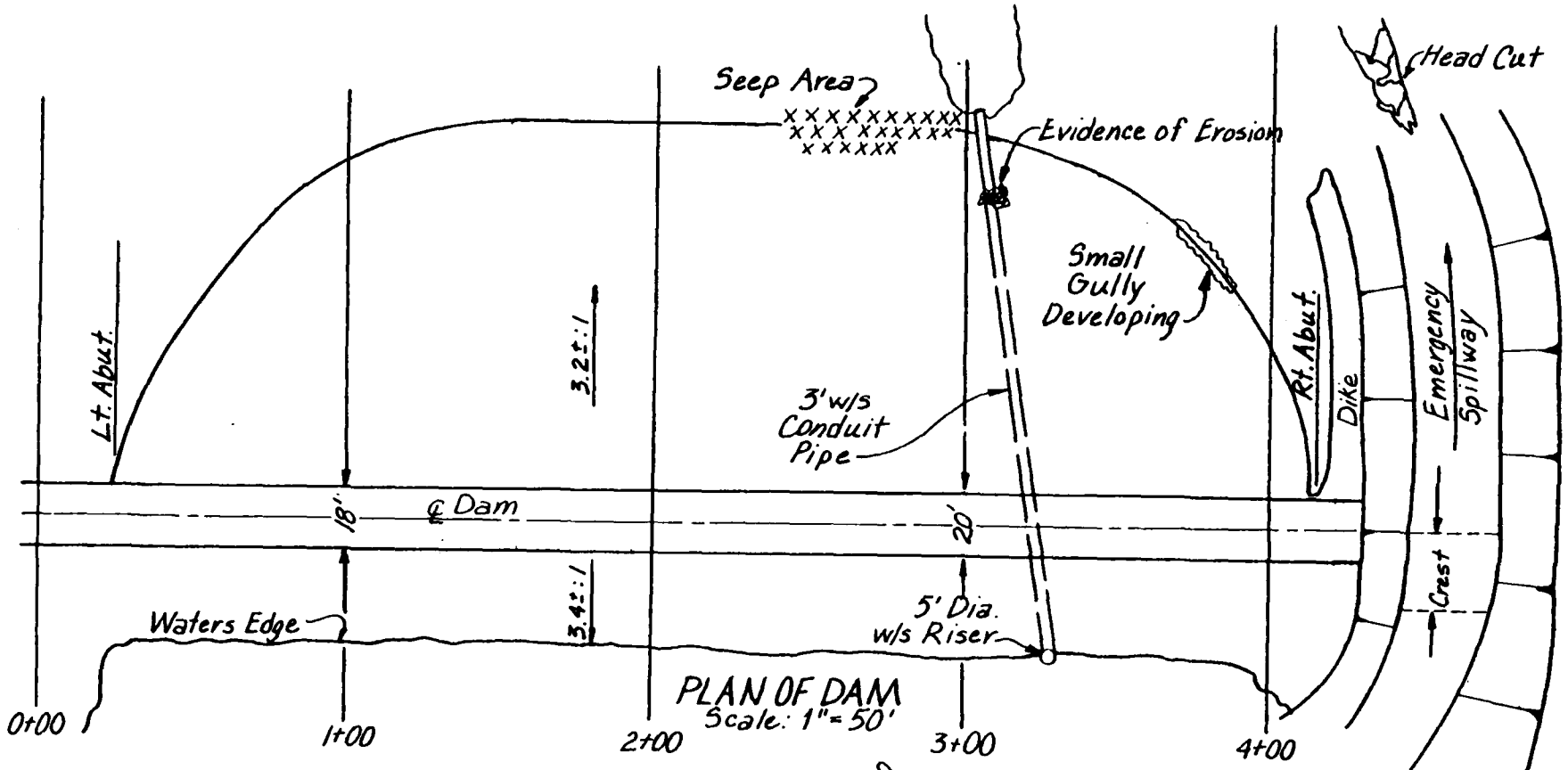


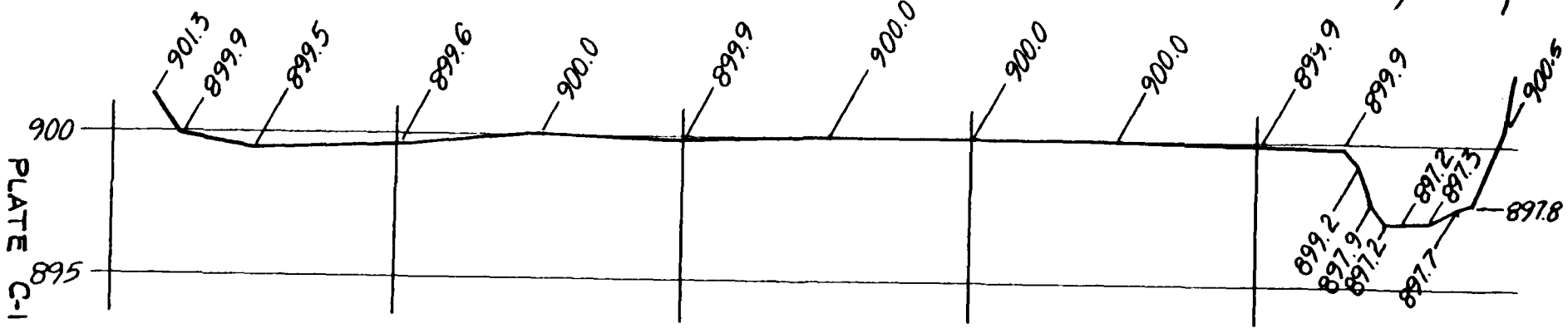
PHOTO NO. 25 - DOWNSTREAM HAZARD ON RIGHT BANK APPROXIMATELY 3/4 MILE DOWNSTREAM

PHOTO NO. 26 - DWELLING APPROXIMATELY 0.2 MILES DOWNSTREAM OF DAM

APPENDIX C
PROJECT PLATES

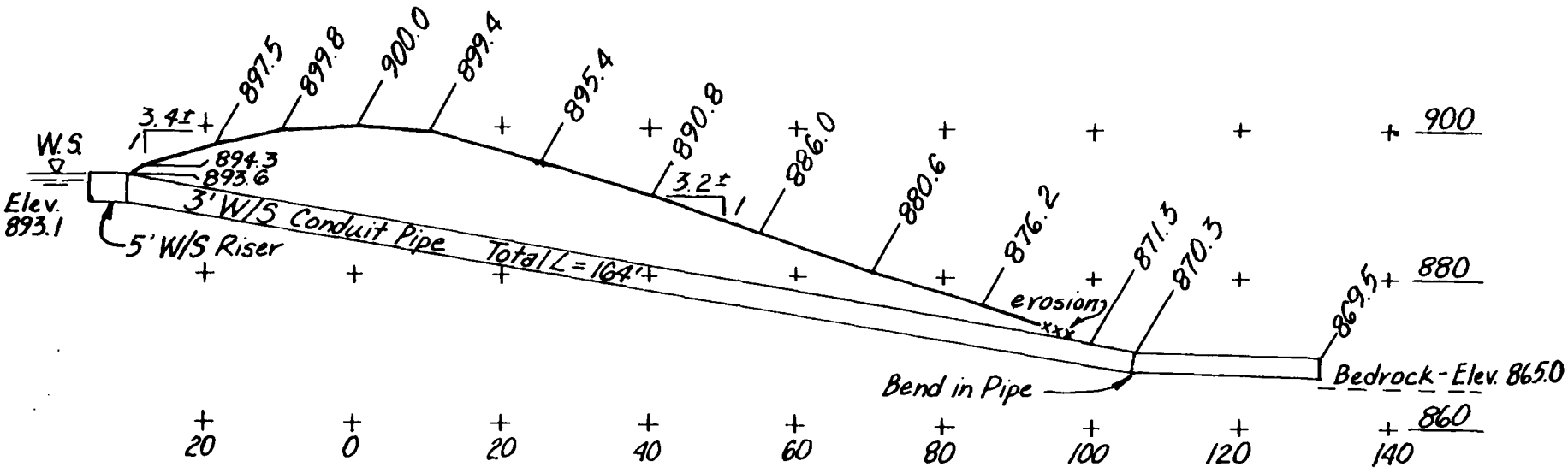


PLAN OF DAM
Scale: 1" = 50'



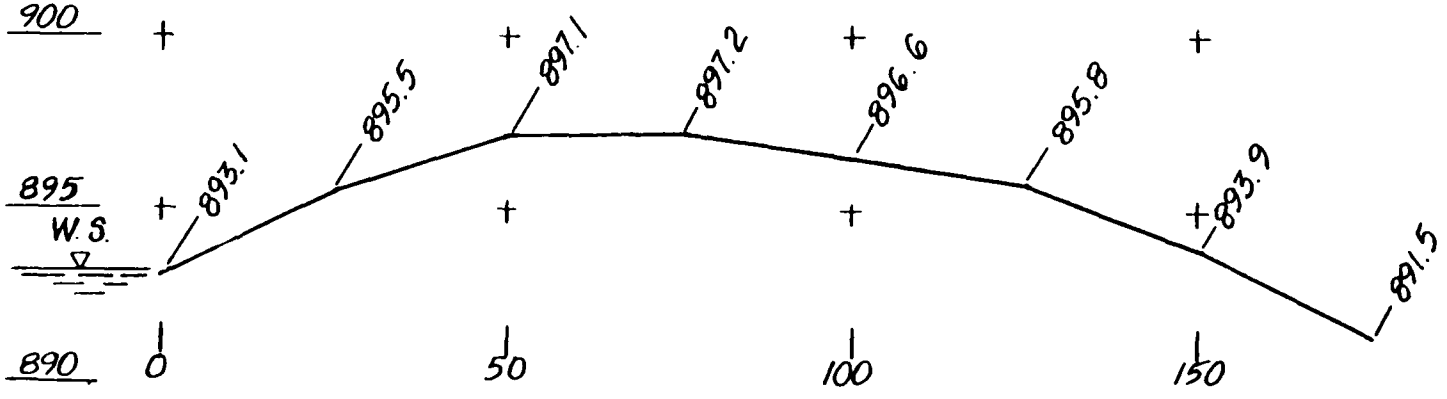
PROFILE ALONG CENTERLINE OF DAM
Scale: 1" = 50'H
1" = 5'V

PLATE C-1



MAXIMUM CROSS-SECTION OF DAM AT STA. 3+00

Scale: 1" = 20'



PROFILE ALONG CENTERLINE OF EMERGENCY SPILLWAY

Scale: 1" = 25' H

1" = 5' V

PLATE C-2

APPENDIX D
HYDRAULIC AND HYDROLOGIC DATA

HYDROLOGIC COMPUTATIONS

1. The SCS dimensionless unit hydrograph and the systemized computer program HEC-1 (Dam Safety Version), July 1978, prepared by the Hydrologic Engineering Center, U. S. Corps of Engineers, Davis, California, were used to develop the inflow hydrographs (See this Appendix).

   a. Twenty-four hour, one percent probabilistic rainfall for the dam location was taken from the data for the rainfall station at Kansas City, MO. as supplied by the St. Louis District, Corps of Engineers per their letter dated 4 March 1980. The twenty-four hour probable maximum precipitation was taken from the curves of Hydrometeorological Report No. 33 and current Corps of Engineers and St. Louis policy and guidance for hydraulics and hydrology.

   b. Drainage area = 0.87 square miles (557 acres).

   c. Time of concentration of runoff = 35 minutes (computed from the "Kirpich" method and checked by SCS "Upland" method).

   d. The antecedent storm conditions for the probable maximum precipitation were heavy rainfall and low temperatures which occurred on the previous 5 days (SCS AMC III). The antecedent storm conditions for the one percent probabilistic precipitation were an average of the conditions which have preceded the occurrence of the maximum annual flood on numerous watersheds (SCS AMC II). The initial pool elevation was assumed at the invert of the principal spillway.

   e. The total twenty-four hour storm duration losses for the ten percent probabilistic storm were 1.95 inches. The total losses for the PMF storm were 1.02 inches. These data are based on SCS runoff curve No. 82 and No. 92 for antecedent moisture conditions, SCS AMC II and AMC III respectively. The watershed is composed primarily of SCS hydrologic soil groups C and D (Lagonda-Lamoni-Armster-Snead Soil Association). The contributing area is approximately 30% wooded, 30% in pasture and meadow, and the remainder under cultivation in straight and contoured row crops.

   f. Average soil loss rates = 0.05 inch per hour approximately (For PMF storm, AMC III).

2. The combined outflow discharge rating consisted of three components: the flow through the principal spillway, the flow through the emergency spillway, and the flow going over the top of the dam.

   a. The principal spillway rating was developed by using the weir and orifice flow equations.

1) Weir Flow equation ($Q = CLH^{1.5}$)
where C = weir coefficient = 3.4 (from SCS Engr. Memo 50)
L = effective weir length, ft. = 15.7'
H = total head, ft.

2) Orifice equation - ($Q = CA\sqrt{2gh}$)
where C = orifice coefficient = 0.6
A = area of conduit sq. ft. = 7.07
h = total head, ft.

b. The emergency spillway rating curve was developed using the Corps of Engineers Water Surface Profile HEC-2 computer program, assuming critical depth downstream from the crest.

c. The flows over the dam were determined by using the dam overtopping analyses (irregular top of dam) within the HEC-1 (Dam Safety Version) program.

3. Floods were routed through the reservoir using the HEC-1 (Dam Safety Version) program to determine the capabilities of the spillway and dam embankment crest. The input, output and plotted hydrographs are attached in this Section.

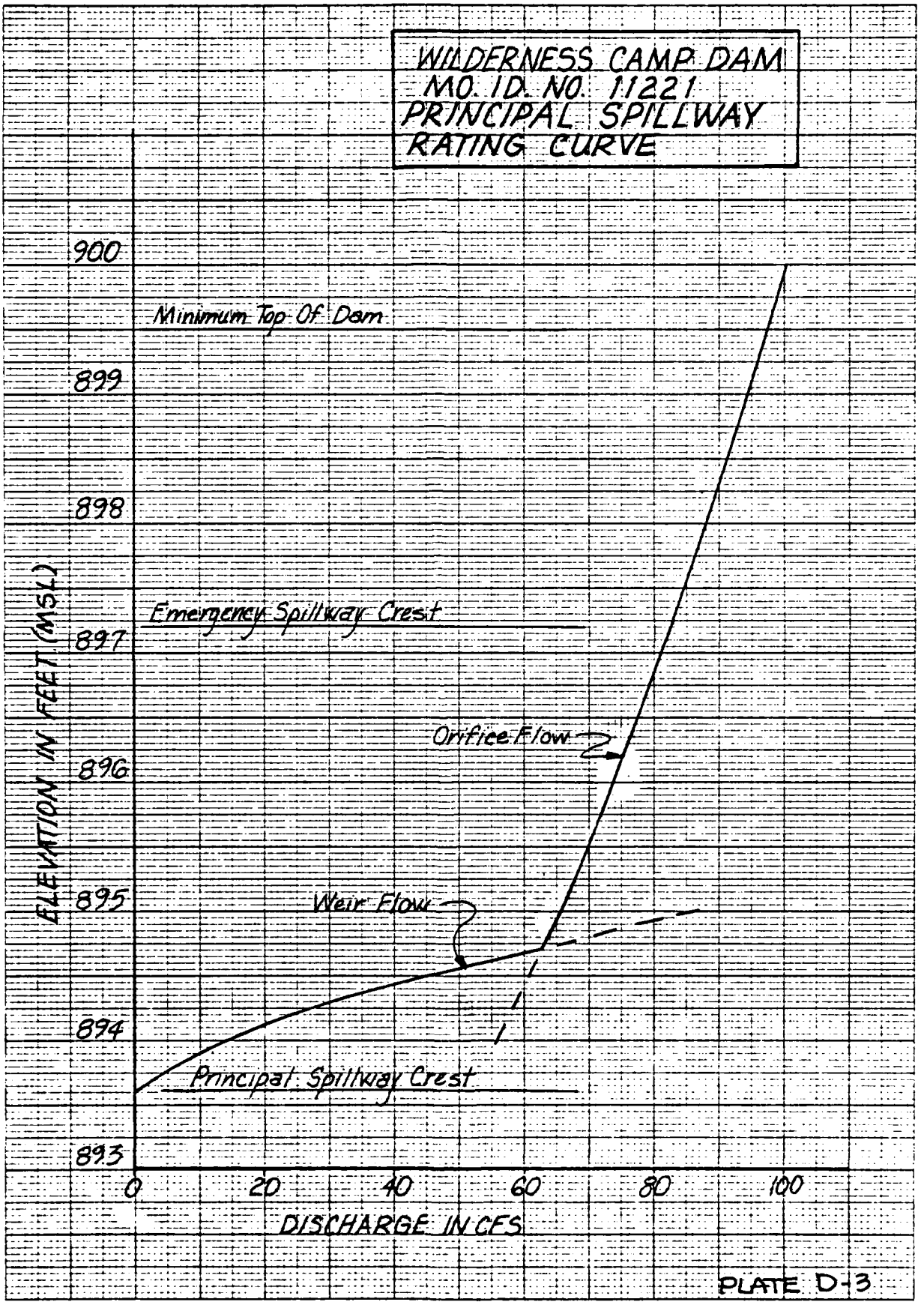

WILDERNESS CAMP DAM
MO. ID. NO. 11221
PRINCIPAL SPILLWAY
RATING CURVE
900
899
898
897
896
895
894
893
Minimum Top Of Dam
Emergency Spillway Crest
Orifice Flow
Weir Flow
Principal Spillway Crest
ELEVATION IN FEET (MSL)
0
20
40
60
80
100
DISCHARGE IN CFS

PLATE D-3

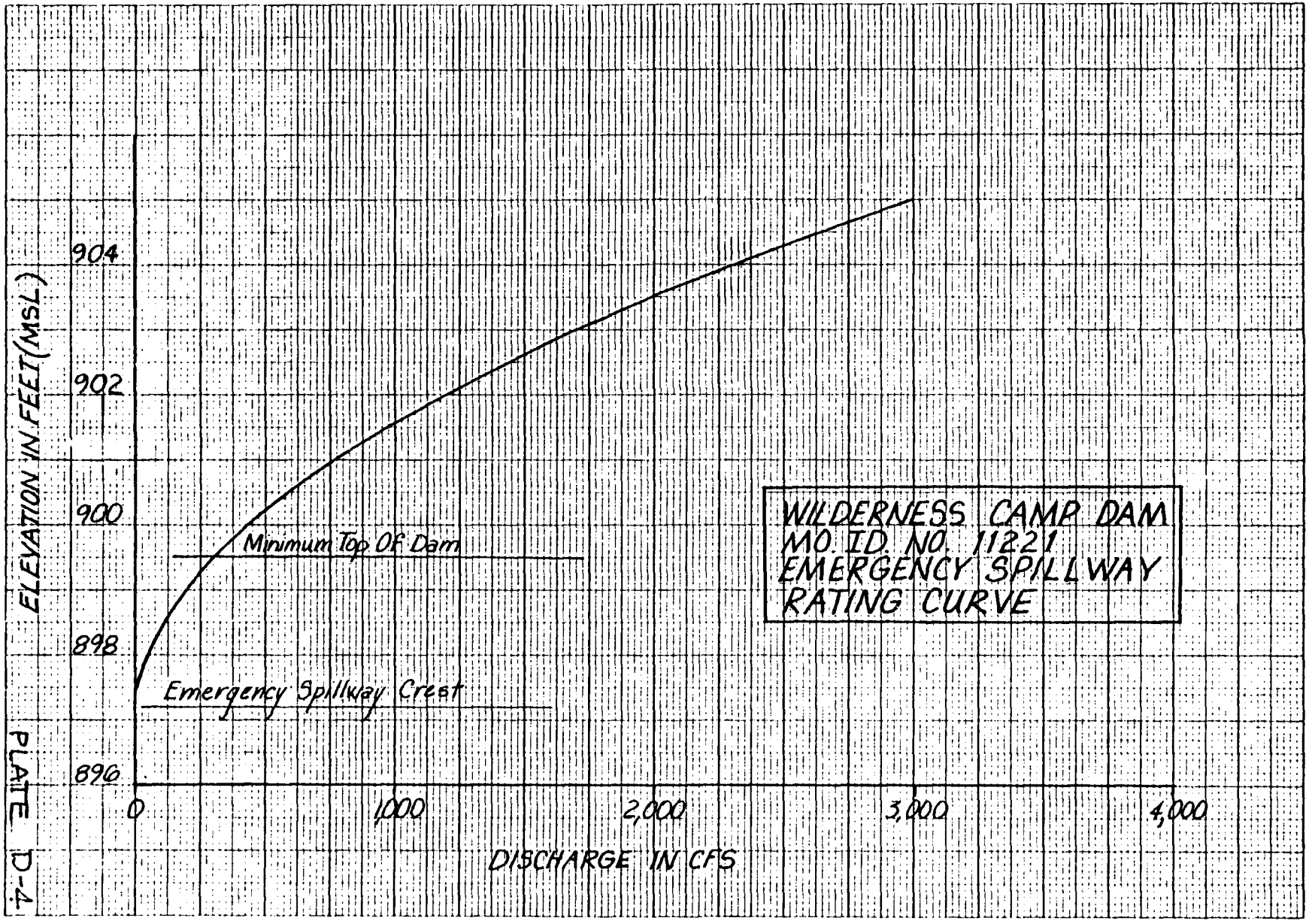


PLATE D-4

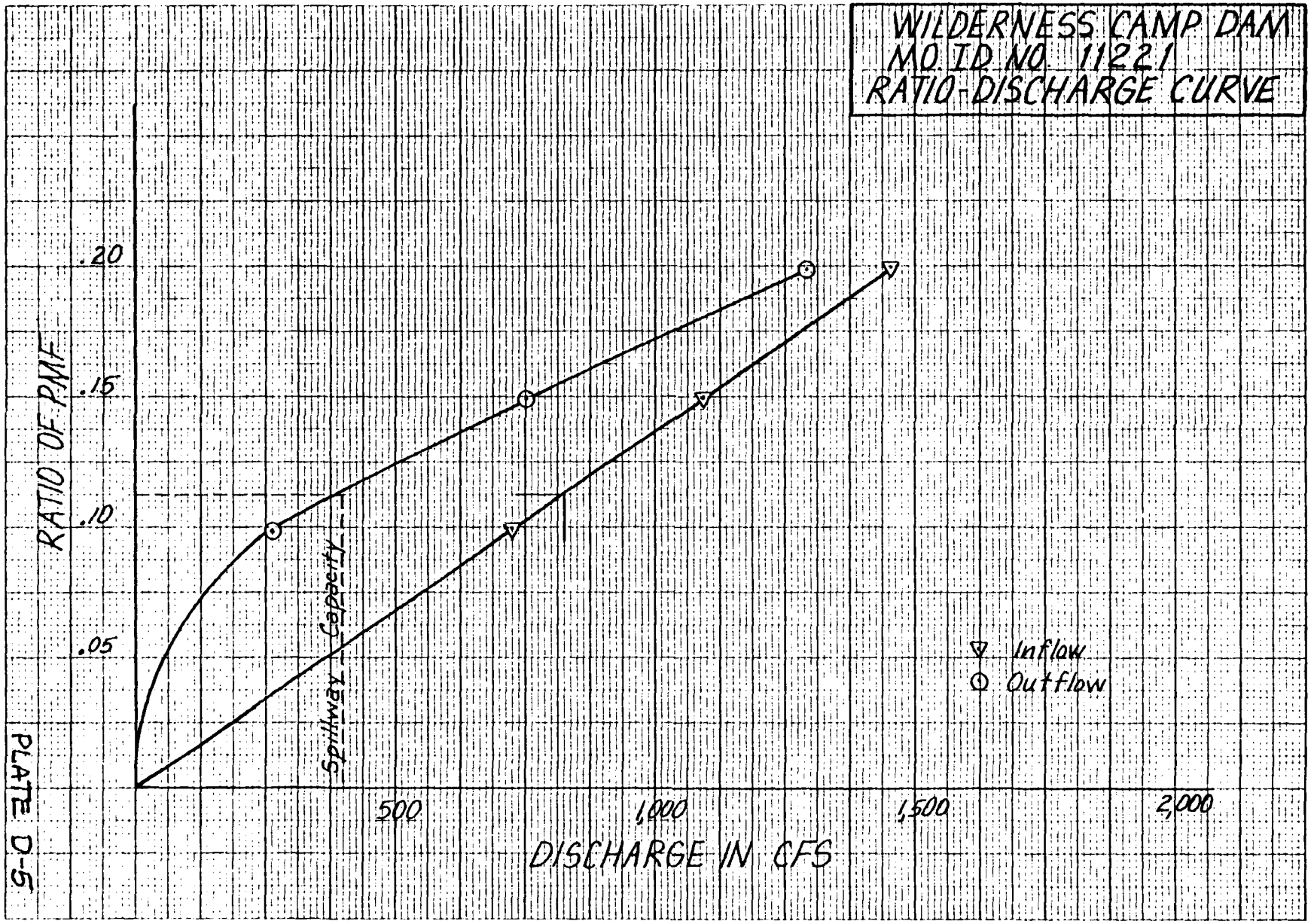


PLATE D-5

LISTING OF CARD INPUT DATA

```
A1                        WILDERNESS CAMP DAM / MO. ID. NO. 11221
A2       SAFETY ANALYSIS OF DAM OVERTOPPING USING ASSIGNED FLOOD FREQUENCIES
A3                H & H ANALYSIS BY ROUTING PMF RATIOS THRU THE RESERVOIR
B     2880000000000000005                                  000000000000000000000003
B1      5
J       100000008000000001
J1    .1000000.1500000.2000000.3000000.4000000.5000000.75000001.0
K       000000001                    000000000000000000000001
K1       CALCULATION OF INFLOW HYDRO TO WILDERNESS CAMP RESERVOIR
M       100000002000000.87           00000.87000001.0                    00000001
P       0000024.300000102000001210000130
T                                                                -1.0    -92.0
W2       0000.347
X       0     -.0100000001
K       100000002                    000000020000000000000001
K1       ROUTED FLOWS THRU WILDERNESS CAMP DAM
Y                          0000000100000001
Y1      1                                                 -893.6       -1
Y4 893.6000894.0000894.5000894.7000895.0000895.5000896.0000897.2000898.0000898.5
Y4 899.0000899.5000900.0000901.0000902.0000903.0000904.0000905.0
Y5      0000013.500000046000000630000006500000070000000740000008200000128000000181
Y5    27400000397000005300000085600001301000018160000243100003126
$A      0000000.3000002.1000006.5000008.7000014.9000019.7000024.3
$E    865000008700000088000008900008 93.1000009000000905000009 10
$$ 893.6
$D 899.5000002.8000001.500000415
$L      000000057000001120000014400000305000004050000041500000425
SV 899.5000899.6000899.9000899.9000900.0000900.0000901.3000904.1
K      99
A
A
A
A
A
```

PLATE D-6

****
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION JULY 1978
LAST MODIFICATION 26 FEB 79
****

RUN DATE= 80/08/05.
TIME= 17.03.18.

WILDERNESS CAMP DAM / MO. ID. NO. 11221
SAFETY ANALYSIS OF DAM OVERTOPPING USING ASSIGNED FLOOD FREQUENCIES
H & H ANALYSIS BY ROUTING PMF RATIOS THRU THE RESERVOIR

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
288	0	5	0	0	0	0	0	3	0
			JOPER	NWT	LROPT	TRACE			
			5	0	0	0			

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 8 LRTIO= 1

RTIOS=	.10	.15	.20	.30	.40	.50	.75	1.00

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

CALCULATION OF INFLOW HYDRO TO WILDERNESS CAMP RESERVOIR

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
000001	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUNG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	2	.87	0.00	.87	1.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	24.30	102.00	121.00	130.00	0.00	0.00	0.00

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	-1.00	-92.00	0.00	0.00

CURVE NO = -92.00 WETNESS = -1.00 EFFECT CN = 92.00

UNIT HYDROGRAPH DATA
TC= 0.00 LAG= .35

RECESSION DATA
STRTQ= 0.00 QRCSN= -.01 RTIOR= 1.00

UNIT HYDROGRAPH 23 END OF PERIOD ORDINATES, TC= 0.00 HOURS, LAG= .35 VOL= 1.00

122.	385.	788.	1043.	1073.	940.	734.	486.	341.	246.
172.	122.	85.	59.	42.	30.	21.	15.	11.	8.
5.	3.	1.							

PLATE D-7

0 MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	END-OF-PERIOD FLOW COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1.01	.05	1	.01	0.00	.01	0.	1.01	12.05	145	.21	.20	.00	439.
1.01	.10	2	.01	0.00	.01	0.	1.01	12.10	146	.21	.20	.00	493.
1.01	.15	3	.01	0.00	.01	0.	1.01	12.15	147	.21	.20	.00	604.
1.01	.20	4	.01	0.00	.01	0.	1.01	12.20	148	.21	.20	.00	750.
1.01	.25	5	.01	0.00	.01	0.	1.01	12.25	149	.21	.20	.00	901.
1.01	.30	6	.01	0.00	.01	0.	1.01	12.30	150	.21	.20	.00	1033.
1.01	.35	7	.01	0.00	.01	0.	1.01	12.35	151	.21	.20	.00	1137.
1.01	.40	8	.01	0.00	.01	0.	1.01	12.40	152	.21	.20	.00	1205.
1.01	.45	9	.01	0.00	.01	0.	1.01	12.45	153	.21	.20	.00	1254.
1.01	.50	10	.01	0.00	.01	0.	1.01	12.50	154	.21	.20	.00	1290.
1.01	.55	11	.01	0.00	.01	0.	1.01	12.55	155	.21	.20	.00	1315.
1.01	1.00	12	.01	0.00	.01	0.	1.01	13.00	156	.21	.20	.00	1333.
1.01	1.05	13	.01	0.00	.01	0.	1.01	13.05	157	.25	.25	.00	1351.
1.01	1.10	14	.01	0.00	.01	0.	1.01	13.10	158	.25	.25	.00	1376.
1.01	1.15	15	.01	.00	.01	0.	1.01	13.15	159	.25	.25	.00	1415.
1.01	1.20	16	.01	.00	.01	0.	1.01	13.20	160	.25	.25	.00	1462.
1.01	1.25	17	.01	.00	.01	0.	1.01	13.25	161	.25	.25	.00	1510.
1.01	1.30	18	.01	.00	.01	1.	1.01	13.30	162	.25	.25	.00	1551.
1.01	1.35	19	.01	.00	.01	2.	1.01	13.35	163	.25	.25	.00	1584.
1.01	1.40	20	.01	.00	.01	3.	1.01	13.40	164	.25	.25	.00	1605.
1.01	1.45	21	.01	.00	.01	4.	1.01	13.45	165	.25	.25	.00	1621.
1.01	1.50	22	.01	.00	.01	6.	1.01	13.50	166	.25	.25	.00	1632.
1.01	1.55	23	.01	.00	.01	7.	1.01	13.55	167	.25	.25	.00	1640.
1.01	2.00	24	.01	.00	.01	9.	1.01	14.00	168	.25	.25	.00	1645.
1.01	2.05	25	.01	.00	.01	11.	1.01	14.05	169	.31	.31	.00	1657.
1.01	2.10	26	.01	.00	.01	12.	1.01	14.10	170	.31	.31	.00	1684.
1.01	2.15	27	.01	.00	.01	14.	1.01	14.15	171	.31	.31	.00	1734.
1.01	2.20	28	.01	.00	.01	16.	1.01	14.20	172	.31	.31	.00	1800.
1.01	2.25	29	.01	.00	.01	17.	1.01	14.25	173	.31	.31	.00	1868.
1.01	2.30	30	.01	.00	.01	19.	1.01	14.30	174	.31	.31	.00	1927.
1.01	2.35	31	.01	.00	.01	20.	1.01	14.35	175	.31	.31	.00	1973.
1.01	2.40	32	.01	.00	.01	22.	1.01	14.40	176	.31	.31	.00	2004.
1.01	2.45	33	.01	.00	.01	23.	1.01	14.45	177	.31	.31	.00	2026.
1.01	2.50	34	.01	.00	.01	25.	1.01	14.50	178	.31	.31	.00	2041.
1.01	2.55	35	.01	.00	.01	26.	1.01	14.55	179	.31	.31	.00	2052.
1.01	3.00	36	.01	.00	.01	27.	1.01	15.00	180	.31	.31	.00	2060.
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1.01	3.15	39	.01	.01	.01	31.	1.01	15.15	183	.38	.38	.00	2011.
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1.01	3.30	42	.01	.01	.01	34.	1.01	15.30	186	1.60	1.60	.00	2598.
1.01	3.35	43	.01	.01	.01	35.	1.01	15.35	187	2.64	2.63	.00	3445.
1.01	3.40	44	.01	.01	.01	36.	1.01	15.40	188	1.04	1.03	.00	4768.
1.01	3.45	45	.01	.01	.01	37.	1.01	15.45	189	.66	.66	.00	6231.
1.01	3.50	46	.01	.01	.01	38.	1.01	15.50	190	.57	.56	.00	7164.
1.01	3.55	47	.01	.01	.01	39.	1.01	15.55	191	.38	.38	.00	7322.
1.01	4.00	48	.01	.01	.01	40.	1.01	16.00	192	.38	.38	.00	6859.
1.01	4.05	49	.01	.01	.01	40.	1.01	16.05	193	.29	.29	.00	6003.
1.01	4.10	50	.01	.01	.01	41.	1.01	16.10	194	.29	.29	.00	5033.
1.01	4.15	51	.01	.01	.01	42.	1.01	16.15	195	.29	.29	.00	4250.
1.01	4.20	52	.01	.01	.01	43.	1.01	16.20	196	.29	.29	.00	3634.
1.01	4.25	53	.01	.01	.01	43.	1.01	16.25	197	.29	.29	.00	3150.
1.01	4.30	54	.01	.01	.01	44.	1.01	16.30	198	.29	.29	.00	2798.
1.01	4.35	55	.01	.01	.00	45.	1.01	16.35	199	.29	.29	.00	2543.
1.01	4.40	56	.01	.01	.00	46.	1.01	16.40	200	.29	.29	.00	2365.
1.01	4.45	57	.01	.01	.00	46.	1.01	16.45	201	.29	.29	.00	2242.
1.01	4.50	58	.01	.01	.00	47.	1.01	16.50	202	.29	.29	.00	2155.
1.01	4.55	59	.01	.01	.00	48.	1.01	16.55	203	.29	.29	.00	2094.

1.01	5.00	60	.01	.01	.00	48.	1.01	17.00	204	.29	.29	.00	2051.
1.01	5.05	61	.01	.01	.00	49.	1.01	17.05	205	.23	.23	.00	2013.
1.01	5.10	62	.01	.01	.00	49.	1.01	17.10	206	.23	.23	.00	1967.
1.01	5.15	63	.01	.01	.00	50.	1.01	17.15	207	.23	.23	.00	1901.
1.01	5.20	64	.01	.01	.00	50.	1.01	17.20	208	.23	.23	.00	1822.
1.01	5.25	65	.01	.01	.00	51.	1.01	17.25	209	.23	.23	.00	1745.
1.01	5.30	66	.01	.01	.00	52.	1.01	17.30	210	.23	.23	.00	1681.
1.01	5.35	67	.01	.01	.00	52.	1.01	17.35	211	.23	.23	.00	1633.
1.01	5.40	68	.01	.01	.00	53.	1.01	17.40	212	.23	.23	.00	1601.
1.01	5.45	69	.01	.01	.00	53.	1.01	17.45	213	.23	.23	.00	1580.
1.01	5.50	70	.01	.01	.00	53.	1.01	17.50	214	.23	.23	.00	1564.
1.01	5.55	71	.01	.01	.00	54.	1.01	17.55	215	.23	.23	.00	1554.
1.01	6.00	72	.01	.01	.00	54.	1.01	18.00	216	.23	.23	.00	1546.
1.01	6.05	73	.06	.05	.02	59.	1.01	18.05	217	.02	.02	.00	1515.
1.01	6.10	74	.06	.05	.02	74.	1.01	18.10	218	.02	.02	.00	1431.
1.01	6.15	75	.06	.05	.02	104.	1.01	18.15	219	.02	.02	.00	1264.
1.01	6.20	76	.06	.05	.02	145.	1.01	18.20	220	.02	.02	.00	1044.
1.01	6.25	77	.06	.05	.01	187.	1.01	18.25	221	.02	.02	.00	819.
1.01	6.30	78	.06	.05	.01	226.	1.01	18.30	222	.02	.02	.00	622.
1.01	6.35	79	.06	.05	.01	259.	1.01	18.35	223	.02	.02	.00	468.
1.01	6.40	80	.06	.05	.01	282.	1.01	18.40	224	.02	.02	.00	366.
1.01	6.45	81	.06	.05	.01	301.	1.01	18.45	225	.02	.02	.00	294.
1.01	6.50	82	.06	.05	.01	316.	1.01	18.50	226	.02	.02	.00	243.
1.01	6.55	83	.06	.05	.01	327.	1.01	18.55	227	.02	.02	.00	207.
1.01	7.00	84	.06	.06	.01	337.	1.01	19.00	228	.02	.02	.00	181.
1.01	7.05	85	.06	.06	.01	345.	1.01	19.05	229	.02	.02	.00	164.
1.01	7.10	86	.06	.06	.01	352.	1.01	19.10	230	.02	.02	.00	151.
1.01	7.15	87	.06	.06	.01	358.	1.01	19.15	231	.02	.02	.00	142.
1.01	7.20	88	.06	.06	.01	363.	1.01	19.20	232	.02	.02	.00	136.
1.01	7.25	89	.06	.06	.01	367.	1.01	19.25	233	.02	.02	.00	132.
1.01	7.30	90	.06	.06	.01	371.	1.01	19.30	234	.02	.02	.00	129.
1.01	7.35	91	.06	.06	.01	375.	1.01	19.35	235	.02	.02	.00	126.
1.01	7.40	92	.06	.06	.01	378.	1.01	19.40	236	.02	.02	.00	125.
1.01	7.45	93	.06	.06	.01	381.	1.01	19.45	237	.02	.02	.00	123.
1.01	7.50	94	.06	.06	.01	383.	1.01	19.50	238	.02	.02	.00	123.
1.01	7.55	95	.06	.06	.01	386.	1.01	19.55	239	.02	.02	.00	123.
1.01	8.00	96	.06	.06	.01	388.	1.01	20.00	240	.02	.02	.00	123.
1.01	8.05	97	.06	.06	.00	390.	1.01	20.05	241	.02	.02	.00	123.
1.01	8.10	98	.06	.06	.00	392.	1.01	20.10	242	.02	.02	.00	123.
1.01	8.15	99	.06	.06	.00	394.	1.01	20.15	243	.02	.02	.00	123.
1.01	8.20	100	.06	.06	.00	395.	1.01	20.20	244	.02	.02	.00	123.
1.01	8.25	101	.06	.06	.00	397.	1.01	20.25	245	.02	.02	.00	123.
1.01	8.30	102	.06	.06	.00	398.	1.01	20.30	246	.02	.02	.00	123.
1.01	8.35	103	.06	.06	.00	400.	1.01	20.35	247	.02	.02	.00	123.
1.01	8.40	104	.06	.06	.00	401.	1.01	20.40	248	.02	.02	.00	123.
1.01	8.45	105	.06	.06	.00	402.	1.01	20.45	249	.02	.02	.00	123.
1.01	8.50	106	.06	.06	.00	403.	1.01	20.50	250	.02	.02	.00	123.
1.01	8.55	107	.06	.06	.00	404.	1.01	20.55	251	.02	.02	.00	123.
1.01	9.00	108	.06	.06	.00	405.	1.01	21.00	252	.02	.02	.00	123.
1.01	9.05	109	.06	.06	.00	406.	1.01	21.05	253	.02	.02	.00	123.
1.01	9.10	110	.06	.06	.00	407.	1.01	21.10	254	.02	.02	.00	123.
1.01	9.15	111	.06	.06	.00	408.	1.01	21.15	255	.02	.02	.00	123.
1.01	9.20	112	.06	.06	.00	409.	1.01	21.20	256	.02	.02	.00	123.
1.01	9.25	113	.06	.06	.00	410.	1.01	21.25	257	.02	.02	.00	123.
1.01	9.30	114	.06	.06	.00	410.	1.01	21.30	258	.02	.02	.00	123.
1.01	9.35	115	.06	.06	.00	411.	1.01	21.35	259	.02	.02	.00	123.
1.01	9.40	116	.06	.06	.00	412.	1.01	21.40	260	.02	.02	.00	123.
1.01	9.45	117	.06	.06	.00	412.	1.01	21.45	261	.02	.02	.00	123.
1.01	9.50	118	.06	.06	.00	413.	1.01	21.50	262	.02	.02	.00	123.
1.01	9.55	119	.06	.06	.00	413.	1.01	21.55	263	.02	.02	.00	123.
1.01	10.00	120	.06	.06	.00	414.	1.01	22.00	264	.02	.02	.00	123.
1.01	10.05	121	.06	.06	.00	414.	1.01	22.05	265	.02	.02	.00	123.

1.01	10.10	122	.06	.06	.00	415.	1.01	22.10	266	.02	.02	.00	123.
1.01	10.15	123	.06	.06	.00	415.	1.01	22.15	267	.02	.02	.00	123.
1.01	10.20	124	.06	.06	.00	416.	1. 1	22.20	268	.02	.02	.00	123.
1.01	10.25	125	.06	.06	.00	416.	1.01	22.25	269	.02	.02	.00	123.
1.01	10.30	126	.06	.06	.00	417.	1.01	22.30	270	.02	.02	.00	123.
1.01	10.35	127	.06	.06	.00	417.	1.01	22.35	271	.02	.02	.00	123.
1.01	10.40	128	.06	.06	.00	418.	1.01	22.40	272	.02	.02	.00	123.
1.01	10.45	129	.06	.06	.00	418.	1.01	22.45	273	.02	.02	.00	123.
1.01	10.50	130	.06	.06	.00	418.	1.01	22.50	274	.02	.02	.00	123.
1.01	10.55	131	.06	.06	.00	419.	1.01	22.55	275	.02	.02	.00	123.
1.01	11.00	132	.06	.06	.00	419.	1.01	23.00	276	.02	.02	.00	123.
1.01	11.05	133	.06	.06	.00	419.	1.01	23.05	277	.02	.02	.00	123.
1.01	11.10	134	.06	.06	.00	420.	1.01	23.10	278	.02	.02	.00	123.
1.01	11.15	135	.06	.06	.00	420.	1.01	23.15	279	.02	.02	.00	123.
1.01	11.20	136	.06	.06	.00	420.	1.01	23.20	280	.02	.02	.00	123.
1.01	11.25	137	.06	.06	.00	420.	1.01	23.25	281	.02	.02	.00	123.
1.01	11.30	138	.06	.06	.00	421.	1.01	23.30	282	.02	.02	.00	123.
1.01	11.35	139	.06	.06	.00	421.	1.01	23.35	283	.02	.02	.00	123.
1.01	11.40	140	.06	.06	.00	421.	1.01	23.40	284	.02	.02	.00	123.
1.01	11.45	141	.06	.06	.00	422.	1.01	23.45	285	.02	.02	.00	123.
1.01	11.50	142	.06	.06	.00	422.	1.01	23.50	286	.02	.02	.00	123.
1.01	11.55	143	.06	.06	.00	422.	1.01	23.55	287	.02	.02	.00	123.
1.01	12.00	144	.06	.06	.00	422.	1.02	0.00	288	.02	.02	.00	123.
									SUM	31.59	30.57	1.02	205253.
										(802.)(	776.)(	26.)(	5812.12)

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	7322.	2272.	712.	712.	205174.
CMS	207.	64.	20.	20.	5810.
INCHES		24.29	30.47	30.47	30.47
MM		617.00	773.92	773.92	773.92
AC-FT		1127.	1413.	1413.	1413.
THOUS CU M		1390.	1743.	1743.	1743.

HYDROGRAPH AT STA000001 FOR PLAN 1, RTIO 1

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	732.	227.	71.	71.	20517.
CMS	21.	6.	2.	2.	581.
INCHES		2.43	3.05	3.05	3.05
MM		61.70	77.39	77.39	77.39
AC-FT		113.	141.	141.	141.
THOUS CU M		139.	174.	174.	174.

HYDROGRAPH AT STA000001 FOR PLAN 1, RTIO 2

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1098.	341.	107.	107.	30776.
CMS	31.	10.	3.	3.	871.
INCHES		3.64	4.57	4.57	4.57
MM		92.55	116.09	116.09	116.09
AC-FT		169.	212.	212.	212.
THOUS CU M		208.	261.	261.	261.

HYDROGRAPH AT STA000001 FOR PLAN 1, RTIO 3

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1464.	454.	142.	142.	41035.
CMS	41.	13.	4.	4.	1162.
INCHES		4.86	6.09	6.09	6.09
MM		123.40	154.78	154.78	154.78
AC-FT		225.	283.	283.	283.
THOUS CU M		278.	349.	349.	349.

HYDROGRAPH AT STA000001 FOR PLAN 1, RTIO 4

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2197.	682.	214.	214.	61552.
CMS	62.	19.	6.	6.	1743.
INCHES		7.29	9.14	9.14	9.14
MM		185.10	232.18	232.18	232.18
AC-FT		338.	424.	424.	424.
THOUS CU M		417.	523.	523.	523.

HYDROGRAPH AT STA000001 FOR PLAN 1, RTIO 5

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2929.	909.	285.	285.	82070.
CMS	83.	26.	8.	8.	2324.
INCHES		9.72	12.19	12.19	12.19
MM		246.80	309.57	309.57	309.57
AC-FT		451.	565.	565.	565.
THOUS CU M		556.	697.	697.	697.

HYDROGRAPH AT STA000001 FOR PLAN 1, RTIO 6 [1/2 PMF]

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	3661.	1136.	356.	356.	102587.
CMS	104.	32.	10.	10.	2905.
INCHES		12.15	15.23	15.23	15.23
MM		308.50	386.96	386.96	386.96
AC-FT		563.	707.	707.	707.
THOUS CU M		695.	871.	871.	871.

HYDROGRAPH AT STA000001 FOR PLAN 1, RTIO 7

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	5492.	1704.	534.	534.	153880.
CMS	156.	48.	15.	15.	4357.
INCHES		18.22	22.85	22.85	22.85
MM		462.75	580.44	580.44	580.44
AC-FT		845.	1060.	1060.	1060.
THOUS CU M		1042.	1307.	1307.	1307.

HYDROGRAPH AT STA000001 FOR PLAN 1, RTIO 8 [PMF]

PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME

CFS	7322.	2272.	712.	712.	205174.
CMS	207.	64.	20.	20.	5810.
INCHES		24.29	30.47	30.47	30.47
MM		617.00	773.92	773.92	773.92
AC-FT		1127.	1413.	1413.	1413.
THOUS CU M		1390.	1743.	1743.	1743.

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HYDROGRAPH ROUTING

ROUTED FLOWS THRU WILDERNESS CAMP DAM

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
000002	1	0	0	2	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-894.	-1

STAGE	893.60	894.00	894.50	894.70	895.00	895.50	896.00	897.20	898.00	898.50
	899.00	899.50	900.00	901.00	902.00	903.00	904.00	905.00		
FLOW	0.00	13.50	46.00	63.00	65.00	70.00	74.00	82.00	128.00	181.00
	274.00	397.00	530.00	856.00	1301.00	1816.00	2431.00	3126.00		
SURFACE AREA=	0.	0.	2.	7.	9.	15.	20.	24.		
CAPACITY=	0.	1.	11.	52.	76.	156.	242.	352.		
ELEVATION=	865.	870.	880.	890.	893.	900.	905.	910.		

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
893.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
899.5	2.8	1.5	415.

CREST LENGTH	0.	57.	112.	144.	305.	405.	415.	425.	
AT OR BELOW ELEVATION	899.5	899.6	899.9	899.9	900.0	900.0	901.3	904.1	

~~STATION 000002, PLAN 1, RATIO 1~~

~~END-OF-PERIOD HYDROGRAPH ORDINATES~~

OUTFLOW

0	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
2.	2.	2.	2.	2.	3.	3.	3.	3.	3.
3.	3.	3.	3.	3.	3.	4.	4.	5.	5.

•OVN•

STATION 000002, PLAN 1, RATIO 6 [1/2 PMF]

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	1.	1.	1.	1.	1.
1.	2.	2.	2.	2.	3.	3.	3.	4.	4.
4.	5.	5.	5.	5.	6.	6.	6.	7.	7.
7.	8.	8.	8.	9.	9.	10.	10.	10.	11.
11.	11.	12.	12.	12.	13.	13.	13.	13.	14.
15.	15.	16.	17.	18.	20.	23.	27.	31.	36.
41.	46.	52.	59.	63.	64.	64.	65.	65.	66.
67.	68.	69.	69.	70.	71.	71.	72.	73.	73.
74.	74.	75.	75.	76.	76.	77.	77.	78.	78.
79.	79.	80.	80.	81.	81.	82.	84.	88.	92.
95.	99.	102.	105.	109.	112.	115.	118.	120.	123.
126.	128.	133.	137.	141.	145.	148.	152.	155.	158.
161.	163.	166.	168.	171.	174.	179.	193.	212.	237.
264.	298.	334.	368.	400.	434.	473.	511.	549.	589.
637.	687.	727.	757.	779.	794.	805.	813.	819.	826.
839.	860.	888.	917.	946.	970.	989.	1003.	1014.	1021.
1025.	1023.	1016.	1017.	1043.	1127.	1343.	1773.	2413.	3084.
3482.	3529.	3295.	2902.	2487.	2137.	1852.	1624.	1450.	1320.
1224.	1156.	1105.	1069.	1041.	1017.	991.	961.	926.	892.
861.	837.	817.	803.	792.	784.	776.	759.	722.	663.
596.	540.	488.	441.	403.	373.	344.	316.	289.	267.
250.	234.	219.	205.	193.	181.	175.	169.	163.	157.
152.	147.	143.	138.	134.	130.	127.	125.	123.	121.
119.	118.	116.	114.	113.	111.	110.	108.	107.	105.
104.	103.	101.	100.	99.	98.	97.	95.	94.	93.
92.	91.	90.	89.	89.	88.	87.	86.	85.	85.
84.	83.	82.	82.	82.	82.	82.	82.		

STORAGE

80.	80.	80.	80.	80.	80.	80.	80.	80.	80.
80.	80.	80.	80.	80.	80.	80.	80.	80.	80.
80.	80.	80.	80.	80.	80.	80.	80.	80.	80.
80.	81.	81.	81.	81.	81.	81.	81.	81.	81.
81.	81.	81.	81.	82.	82.	82.	82.	82.	82.
82.	82.	82.	82.	82.	83.	83.	83.	83.	83.
83.	83.	83.	83.	83.	83.	84.	84.	84.	84.
84.	84.	84.	84.	84.	85.	85.	86.	86.	87.
88.	89.	89.	90.	91.	92.	92.	93.	94.	95.
96.	96.	97.	98.	99.	100.	101.	101.	102.	103.
104.	105.	106.	107.	107.	108.	109.	110.	111.	112.
113.	114.	114.	115.	116.	117.	118.	119.	119.	120.
121.	122.	123.	123.	124.	125.	125.	126.	127.	127.
128.	128.	129.	129.	130.	130.	131.	131.	132.	132.
132.	133.	133.	133.	134.	134.	135.	136.	137.	139.
141.	143.	145.	147.	149.	151.	152.	153.	155.	156.
156.	157.	158.	158.	158.	159.	159.	159.	159.	159.
159.	159.	160.	160.	160.	160.	161.	161.	161.	161.
161.	161.	161.	161.	161.	162.	164.	167.	172.	176.
178.	178.	177.	175.	172.	170.	168.	166.	165.	164.
163.	162.	162.	161.	161.	161.	161.	160.	160.	160.
159.	159.	159.	159.	158.	158.	158.	158.	158.	157.
156.	154.	153.	151.	149.	147.	146.	144.	143.	141.
140.	139.	138.	137.	136.	135.	134.	133.	133.	132.

131.	131.	130.	130.	129.	129.	128.	128.	127.	127.
126.	126.	126.	125.	125.	125.	124.	124.	124.	123.
123.	123.	122.	122.	122.	122.	121.	121.	121.	121.
120.	120.	120.	120.	120.	119.	119.	119.	119.	119.
119.	118.	118.	118.	118.	118.	118.	118.		

STAGE

893.6	893.6	893.6	893.6	893.6	893.6	893.6	893.6	893.6	893.6
893.6	893.6	893.6	893.6	893.6	893.6	893.6	893.6	893.6	893.6
893.6	893.6	893.6	893.6	893.6	893.6	893.6	893.6	893.6	893.6
893.6	893.7	893.7	893.7	893.7	893.7	893.7	893.7	893.7	893.7
893.7	893.7	893.7	893.8	893.8	893.8	893.8	893.8	893.8	893.8
893.8	893.8	893.8	893.9	893.9	893.9	893.9	893.9	893.9	893.9
893.9	893.9	893.9	894.0	894.0	894.0	894.0	894.0	894.0	894.0
894.0	894.0	894.0	894.0	894.1	894.1	894.1	894.2	894.3	894.3
894.4	894.5	894.6	894.6	894.7	894.8	894.9	895.0	895.0	895.1
895.2	895.3	895.4	895.4	895.5	895.6	895.7	895.7	895.8	895.9
896.0	896.1	896.1	896.2	896.3	896.4	896.4	896.5	896.6	896.7
896.7	896.8	896.9	897.0	897.0	897.1	897.2	897.2	897.3	897.4
897.4	897.5	897.6	897.6	897.7	897.7	897.8	897.8	897.9	897.9
898.0	898.0	898.0	898.1	898.1	898.2	898.2	898.2	898.3	898.3
898.3	898.3	898.4	898.4	898.4	898.4	898.5	898.6	898.7	898.8
898.9	899.1	899.2	899.4	899.5	899.6	899.7	899.8	899.9	900.0
900.0	900.1	900.1	900.1	900.2	900.2	900.2	900.2	900.2	900.2
900.2	900.2	900.2	900.3	900.3	900.3	900.3	900.3	900.3	900.3
900.3	900.3	900.3	900.3	900.3	900.4	900.5	900.7	901.0	901.3
901.4	901.4	901.4	901.2	901.0	900.9	900.8	900.7	900.6	900.5
900.4	900.4	900.4	900.3	900.3	900.3	900.3	900.3	900.3	900.2
900.2	900.2	900.2	900.2	900.2	900.2	900.1	900.1	900.1	900.1
900.0	899.9	899.8	899.6	899.5	899.4	899.3	899.2	899.1	899.0
898.9	898.8	898.7	898.6	898.6	898.5	898.4	898.4	898.3	898.3
898.2	898.2	898.1	898.1	898.1	898.0	898.0	897.9	897.9	897.9
897.9	897.8	897.8	897.8	897.7	897.7	897.7	897.7	897.6	897.6
897.6	897.6	897.5	897.5	897.5	897.5	897.5	897.4	897.4	897.4
897.4	897.4	897.3	897.3	897.3	897.3	897.3	897.3	897.3	897.2
897.2	897.2	897.2	897.2	897.2	897.2	897.2	897.1		

PEAK OUTFLOW IS 3529. AT TIME 16.00 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	3529.	1111.	337.	337.	97133.
CMS	100.	31.	10.	10.	2751.
INCHES		11.88	14.42	14.42	14.42
MM		301.85	366.39	366.39	366.39
AC-FT		551.	669.	669.	669.
THOUS CU M		680.	825.	825.	825.

OVF

STATION000002

INFLOW(I), OUTFLOW(O) AND OBSERVED FLOW(*)

	0.	500.	1000.	1500.	2000.	2500.	3000.	3500.	4000.	0.	0.	0.	0.
.05	1I	.	.	.	.	.	.	.	.	.	.	.	.
.10	2I	.	.	.	.	.	.	.	.	.	.	.	.
.15	3I	.	.	.	.	.	.	.	.	.	.	.	.
.20	4I	.	.	.	.	.	.	.	.	.	.	.	.
.25	5I	.	.	.	.	.	.	.	.	.	.	.	.
.30	6I	.	.	.	.	.	.	.	.	.	.	.	.
.35	7I	.	.	.	.	.	.	.	.	.	.	.	.
.40	8I	.	.	.	.	.	.	.	.	.	.	.	.
.45	9I	.	.	.	.	.	.	.	.	.	.	.	.
.50	10I	.	.	.	.	.	.	.	.	.	.	.	.
.55	11I	.	.	.	.	.	.	.	.	.	.	.	.
1.00	12I	.	.	.	.	.	.	.	.	.	.	.	.
1.05	13I	.	.	.	.	.	.	.	.	.	.	.	.
1.10	14I	.	.	.	.	.	.	.	.	.	.	.	.
1.15	15I	.	.	.	.	.	.	.	.	.	.	.	.
1.20	16I	.	.	.	.	.	.	.	.	.	.	.	.
1.25	17I	.	.	.	.	.	.	.	.	.	.	.	.
1.30	18I	.	.	.	.	.	.	.	.	.	.	.	.
1.35	19I	.	.	.	.	.	.	.	.	.	.	.	.
1.40	20I	.	.	.	.	.	.	.	.	.	.	.	.
1.45	21I	.	.	.	.	.	.	.	.	.	.	.	.
1.50	22I	.	.	.	.	.	.	.	.	.	.	.	.
1.55	23I	.	.	.	.	.	.	.	.	.	.	.	.
2.00	24I	.	.	.	.	.	.	.	.	.	.	.	.
2.05	25I	.	.	.	.	.	.	.	.	.	.	.	.
2.10	26I	.	.	.	.	.	.	.	.	.	.	.	.
2.15	27I	.	.	.	.	.	.	.	.	.	.	.	.
2.20	28I	.	.	.	.	.	.	.	.	.	.	.	.
2.25	29I	.	.	.	.	.	.	.	.	.	.	.	.
2.30	30I	.	.	.	.	.	.	.	.	.	.	.	.
2.35	31I	.	.	.	.	.	.	.	.	.	.	.	.
2.40	32I	.	.	.	.	.	.	.	.	.	.	.	.
2.45	33I	.	.	.	.	.	.	.	.	.	.	.	.
2.50	34I	.	.	.	.	.	.	.	.	.	.	.	.
2.55	35I	.	.	.	.	.	.	.	.	.	.	.	.
3.00	36I	.	.	.	.	.	.	.	.	.	.	.	.
3.05	37I	.	.	.	.	.	.	.	.	.	.	.	.
3.10	38I	.	.	.	.	.	.	.	.	.	.	.	.
3.15	39I	.	.	.	.	.	.	.	.	.	.	.	.
3.20	40I	.	.	.	.	.	.	.	.	.	.	.	.
3.25	41I	.	.	.	.	.	.	.	.	.	.	.	.
3.30	42I	.	.	.	.	.	.	.	.	.	.	.	.
3.35	43I	.	.	.	.	.	.	.	.	.	.	.	.
3.40	44I	.	.	.	.	.	.	.	.	.	.	.	.
3.45	45I	.	.	.	.	.	.	.	.	.	.	.	.
3.50	46I	.	.	.	.	.	.	.	.	.	.	.	.
3.55	47I	.	.	.	.	.	.	.	.	.	.	.	.
4.00	48I	.	.	.	.	.	.	.	.	.	.	.	.
4.05	49I	.	.	.	.	.	.	.	.	.	.	.	.
4.10	50I	.	.	.	.	.	.	.	.	.	.	.	.
4.15	51I	.	.	.	.	.	.	.	.	.	.	.	.
4.20	52I	.	.	.	.	.	.	.	.	.	.	.	.
4.25	53I	.	.	.	.	.	.	.	.	.	.	.	.
4.30	54I	.	.	.	.	.	.	.	.	.	.	.	.
4.35	55I	.	.	.	.	.	.	.	.	.	.	.	.
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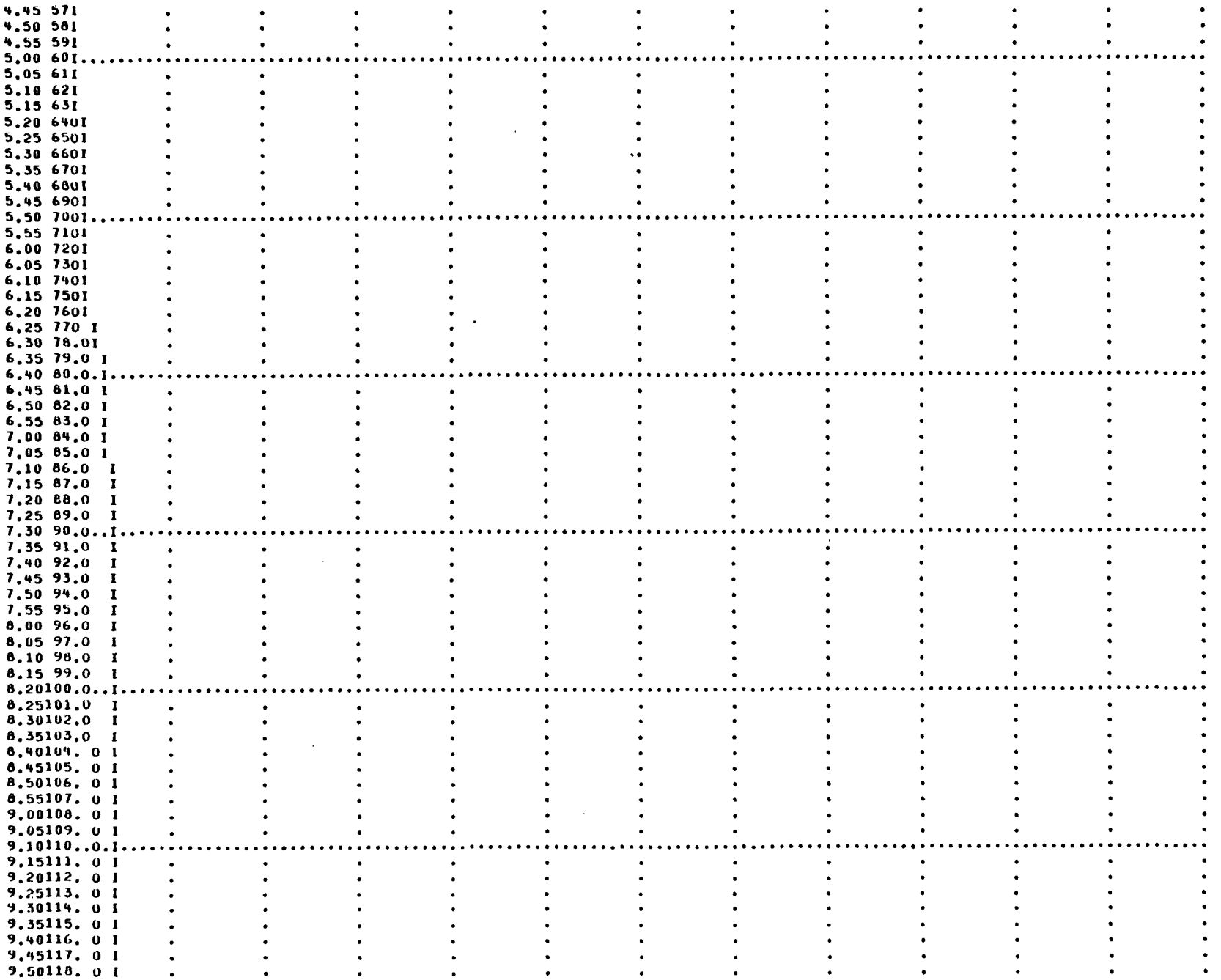
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5.05 611
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5.20 640I
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5.30 660I
5.35 670I
5.40 680I
5.45 690I
5.50 700I
5.55 710I
6.00 720I
6.05 730I
6.10 740I
6.15 750I
6.20 760I
6.25 770 I
6.30 78.0I
6.35 79.0 I
6.40 80.0.I
6.45 81.0 I
6.50 82.0 I
6.55 83.0 I
7.00 84.0 I
7.05 85.0 I
7.10 86.0 I
7.15 87.0 I
7.20 88.0 I
7.25 89.0 I
7.30 90.0..I
7.35 91.0 I
7.40 92.0 I
7.45 93.0 I
7.50 94.0 I
7.55 95.0 I
8.00 96.0 I
8.05 97.0 I
8.10 98.0 I
8.15 99.0 I
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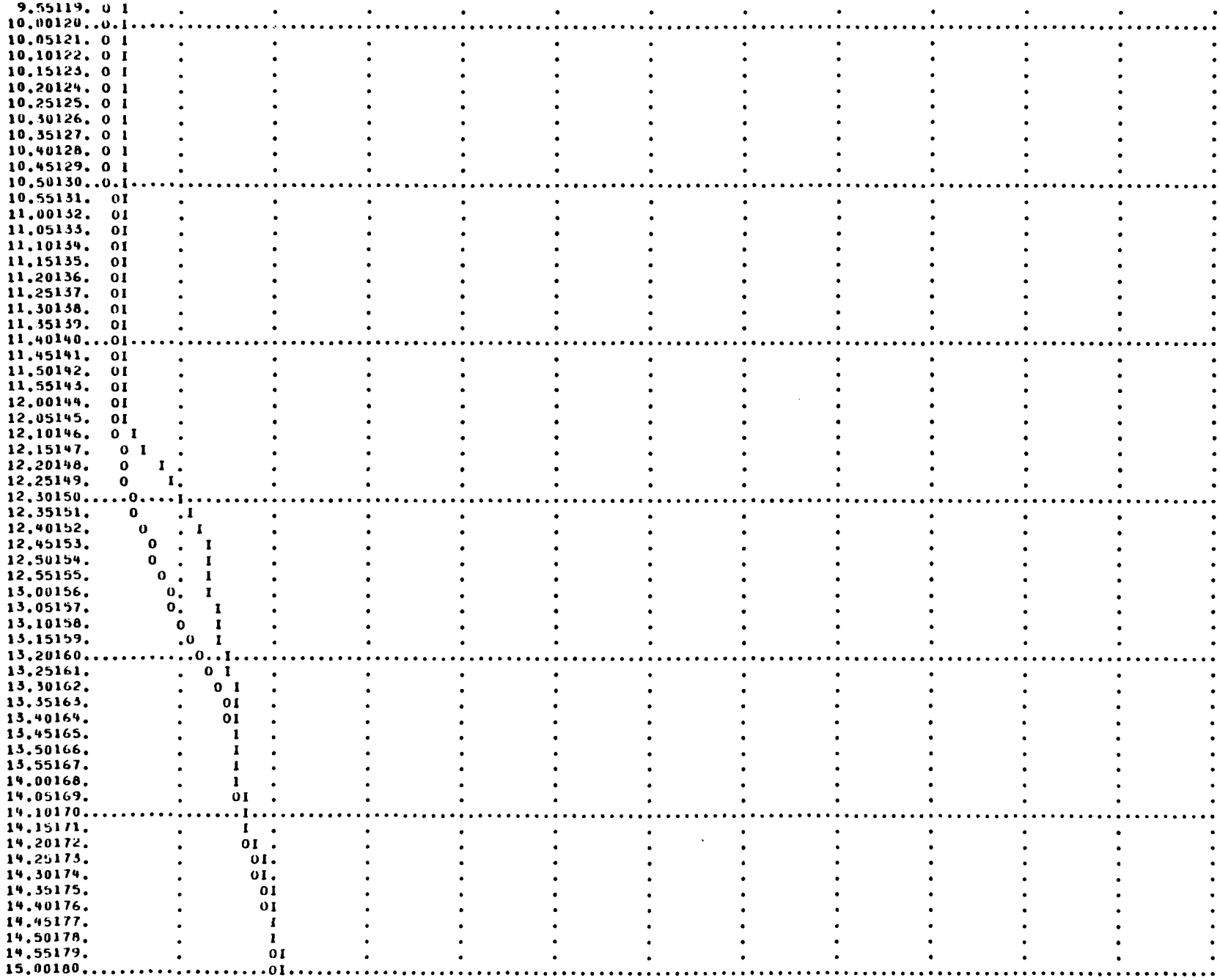
PLATE D-16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10.40128. 0 I
10.45129. 0 I
10.50130. 0 I
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11.50142. 0I
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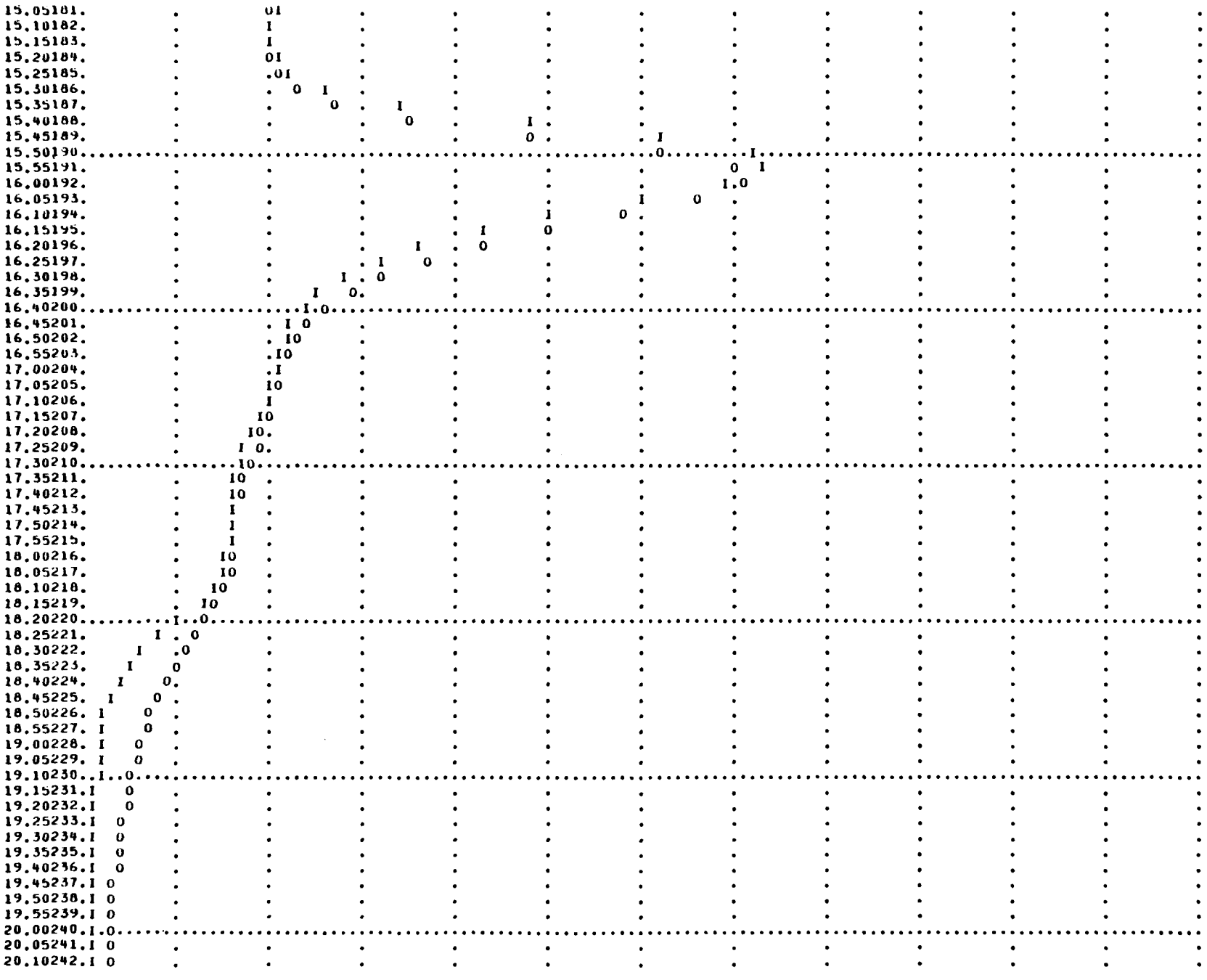
PLATE D-17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16.10194.
16.15195.
16.20196.
16.25197.
16.30198.
16.35199.
16.40200.
16.45201.
16.50202.
16.55203.
17.00204.
17.05205.
17.10206.
17.15207.
17.20208.
17.25209.
17.30210.
17.35211.
17.40212.
17.45213.
17.50214.
17.55215.
18.00216.
18.05217.
18.10218.
18.15219.
18.20220.
18.25221.
18.30222.
18.35223.
18.40224.
18.45225.
18.50226.
18.55227.
19.00228.
19.05229.
19.10230.
19.15231.
19.20232.
19.25233.
19.30234.
19.35235.
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19.45237.
19.50238.
19.55239.
20.00240.
20.05241.
20.10242.

PLATE D-18

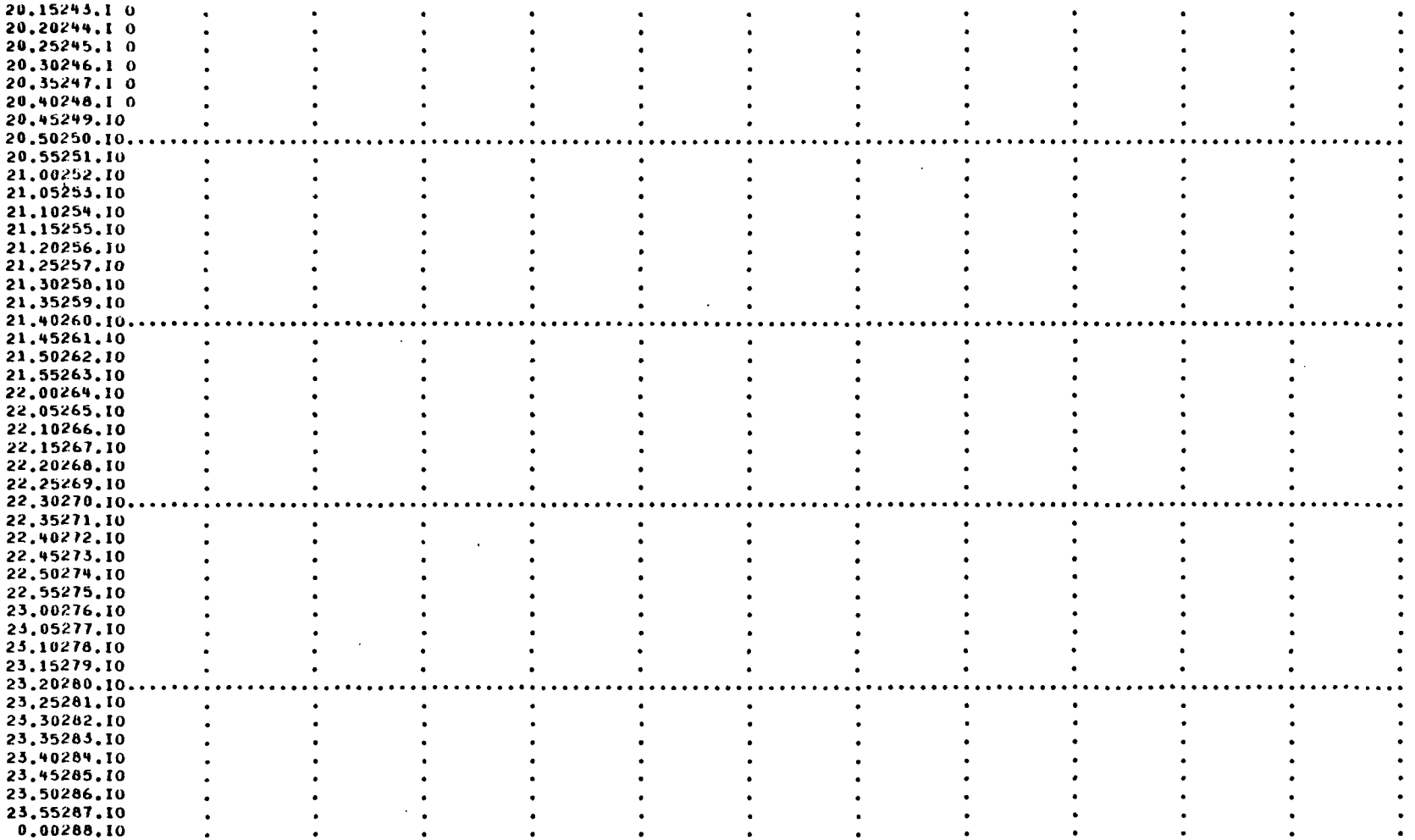
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PLATE D-19

OVIN

STATION 000002, PLAN 1, RATIO 8 PMF

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	1.	1.	1.	1.	2.	2.	3.
3.	3.	4.	4.	5.	5.	6.	7.	7.	8.
8.	9.	10.	10.	11.	12.	12.	13.	14.	15.
16.	17.	18.	20.	21.	22.	23.	24.	25.	26.
27.	28.	29.	30.	31.	32.	33.	34.	35.	35.
36.	37.	38.	39.	41.	45.	52.	61.	64.	65.
66.	68.	69.	71.	72.	73.	75.	76.	77.	78.
79.	80.	82.	88.	98.	107.	115.	124.	135.	149.
162.	175.	191.	210.	227.	243.	257.	270.	284.	298.
311.	322.	332.	340.	348.	355.	361.	367.	372.	377.
381.	385.	388.	391.	394.	396.	399.	401.	403.	405.
406.	408.	409.	410.	412.	413.	414.	415.	415.	416.
417.	417.	418.	418.	420.	426.	445.	484.	550.	676.
858.	1016.	1130.	1208.	1260.	1296.	1322.	1346.	1374.	1411.
1455.	1500.	1540.	1573.	1597.	1615.	1628.	1637.	1646.	1661.
1690.	1738.	1798.	1860.	1917.	1963.	1996.	2020.	2037.	2050.
2054.	2046.	2030.	2033.	2098.	2301.	2808.	3769.	5118.	6413.
7109.	7093.	6537.	5694.	4846.	4140.	3570.	3127.	2795.	2552.
2379.	2259.	2170.	2106.	2058.	2014.	1963.	1898.	1826.	1755.
1694.	1647.	1613.	1588.	1571.	1558.	1542.	1501.	1411.	1262.
1080.	895.	732.	610.	541.	488.	444.	409.	381.	356.
333.	311.	291.	273.	260.	248.	237.	227.	217.	209.
201.	194.	188.	182.	178.	175.	173.	170.	167.	165.
163.	161.	159.	157.	155.	153.	151.	150.	148.	147.
146.	144.	143.	142.	141.	140.	139.	138.	137.	137.
136.	135.	134.	134.	133.	133.	132.	132.	131.	131.
130.	130.	129.	129.	129.	128.	128.	128.		

STORAGE

80.	80.	80.	80.	80.	80.	80.	80.	80.	80.
80.	80.	80.	80.	80.	80.	80.	80.	80.	80.
80.	80.	80.	80.	80.	80.	80.	81.	81.	81.
81.	81.	81.	81.	81.	82.	82.	82.	82.	82.
82.	83.	83.	83.	83.	83.	83.	84.	84.	84.
84.	84.	84.	85.	85.	85.	85.	85.	85.	86.
86.	86.	86.	86.	86.	86.	87.	87.	87.	87.
87.	87.	87.	88.	88.	88.	89.	90.	92.	93.
95.	96.	98.	100.	102.	103.	105.	107.	109.	111.
113.	115.	117.	120.	122.	124.	125.	127.	129.	131.
133.	134.	136.	137.	138.	139.	140.	141.	142.	143.
144.	144.	145.	145.	146.	146.	147.	147.	147.	148.
148.	148.	148.	148.	149.	149.	149.	149.	149.	149.
149.	149.	149.	149.	150.	150.	150.	150.	150.	150.
150.	150.	150.	150.	150.	150.	151.	152.	155.	157.
159.	161.	162.	163.	163.	163.	164.	164.	164.	164.
165.	165.	165.	166.	166.	166.	166.	166.	166.	166.
167.	167.	167.	168.	168.	169.	169.	169.	169.	169.
169.	169.	169.	169.	170.	171.	174.	180.	187.	194.
197.	197.	194.	190.	186.	182.	179.	176.	174.	173.
171.	171.	170.	170.	169.	169.	169.	168.	168.	167.
167.	166.	166.	166.	166.	166.	165.	165.	164.	163.
161.	160.	158.	156.	154.	153.	151.	149.	148.	146.
145.	144.	143.	142.	141.	140.	139.	138.	137.	137.

136.	136.	135.	135.	135.	134.	134.	133.	133.	133.
133.	132.	132.	132.	132.	131.	131.	131.	131.	131.
130.	130.	130.	130.	130.	130.	130.	130.	129.	129.
129.	129.	129.	129.	129.	129.	129.	129.	129.	129.
129.	128.	128.	128.	128.	128.	128.	128.		

STAGE

893.6	893.6	893.6	893.6	893.6	893.6	893.6	893.6	893.6	893.6
893.6	893.6	893.6	893.6	893.6	893.6	893.6	893.6	893.6	893.6
893.6	893.6	893.6	893.6	893.6	893.6	893.6	893.7	893.7	893.7
893.7	893.7	893.7	893.7	893.7	893.8	893.8	893.8	893.8	893.8
893.8	893.9	893.9	893.9	893.9	893.9	894.0	894.0	894.0	894.0
894.0	894.1	894.1	894.1	894.1	894.1	894.1	894.2	894.2	894.2
894.2	894.2	894.2	894.3	894.3	894.3	894.3	894.3	894.3	894.3
894.4	894.4	894.4	894.4	894.4	894.5	894.6	894.7	894.8	894.9
895.1	895.3	895.4	895.6	895.8	895.9	896.1	896.3	896.5	896.6
896.8	897.0	897.1	897.3	897.5	897.6	897.8	897.9	898.1	898.2
898.3	898.4	898.6	898.7	898.7	898.8	898.9	899.0	899.0	899.1
899.1	899.2	899.2	899.3	899.3	899.3	899.4	899.4	899.4	899.4
899.4	899.4	899.5	899.5	899.5	899.5	899.5	899.5	899.5	899.5
899.5	899.5	899.5	899.5	899.6	899.6	899.6	899.6	899.6	899.6
899.6	899.6	899.6	899.6	899.6	899.6	899.7	899.8	899.9	900.1
900.2	900.3	900.4	900.4	900.5	900.5	900.5	900.5	900.5	900.5
900.6	900.6	900.6	900.6	900.6	900.7	900.7	900.7	900.7	900.7
900.7	900.7	900.7	900.8	900.8	900.8	900.8	900.8	900.9	900.9
900.9	900.9	900.9	900.9	900.9	901.0	901.2	901.5	902.0	902.3
902.5	902.5	902.4	902.1	901.9	901.6	901.5	901.3	901.2	901.1
901.0	901.0	900.9	900.9	900.9	900.8	900.8	900.8	900.8	900.7
900.7	900.7	900.7	900.6	900.6	900.6	900.6	900.6	900.5	900.5
900.4	900.2	900.1	900.0	899.9	899.8	899.7	899.5	899.4	899.3
899.2	899.1	899.1	899.0	898.9	898.9	898.8	898.7	898.7	898.7
898.6	898.6	898.5	898.5	898.5	898.4	898.4	898.4	898.4	898.3
898.3	898.3	898.3	898.3	898.3	898.2	898.2	898.2	898.2	898.2
898.2	898.2	898.1	898.1	898.1	898.1	898.1	898.1	898.1	898.1
898.1	898.1	898.1	898.1	898.0	898.0	898.0	898.0	898.0	898.0
898.0	898.0	898.0	898.0	898.0	898.0	898.0	898.0		

PEAK OUTFLOW IS 7109. AT TIME 15.92 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	7109.	2264.	688.	688.	198164.
CMS	201.	64.	19.	19.	5611.
INCHES		24.21	29.43	29.43	29.43
MM		614.84	747.48	747.48	747.48
AC-FT		1123.	1365.	1365.	1365.
THOUS CU M		1385.	1683.	1683.	1683.

OVF

STATION000002

INFLOW(I), OUTFLOW(O) AND OBSERVED FLOW(*)

	0.	1000.	2000.	3000.	4000.	5000.	6000.	7000.	8000.	0.	0.	0.	0.
.05	11												
.10	21												
.15	31												
.20	41												
.25	51												
.30	61												
.35	71												
.40	81												
.45	91												
.50	101												
.55	111												
1.00	121												
1.05	131												
1.10	141												
1.15	151												
1.20	161												
1.25	171												
1.30	181												
1.35	191												
1.40	201												
1.45	211												
1.50	221												
1.55	231												
2.00	241												
2.05	251												
2.10	261												
2.15	271												
2.20	281												
2.25	291												
2.30	301												
2.35	311												
2.40	321												
2.45	331												
2.50	341												
2.55	351												
3.00	361												
3.05	371												
3.10	381												
3.15	391												
3.20	401												
3.25	411												
3.30	421												
3.35	431												
3.40	441												
3.45	451												
3.50	461												
3.55	471												
4.00	481												
4.05	491												
4.10	501												
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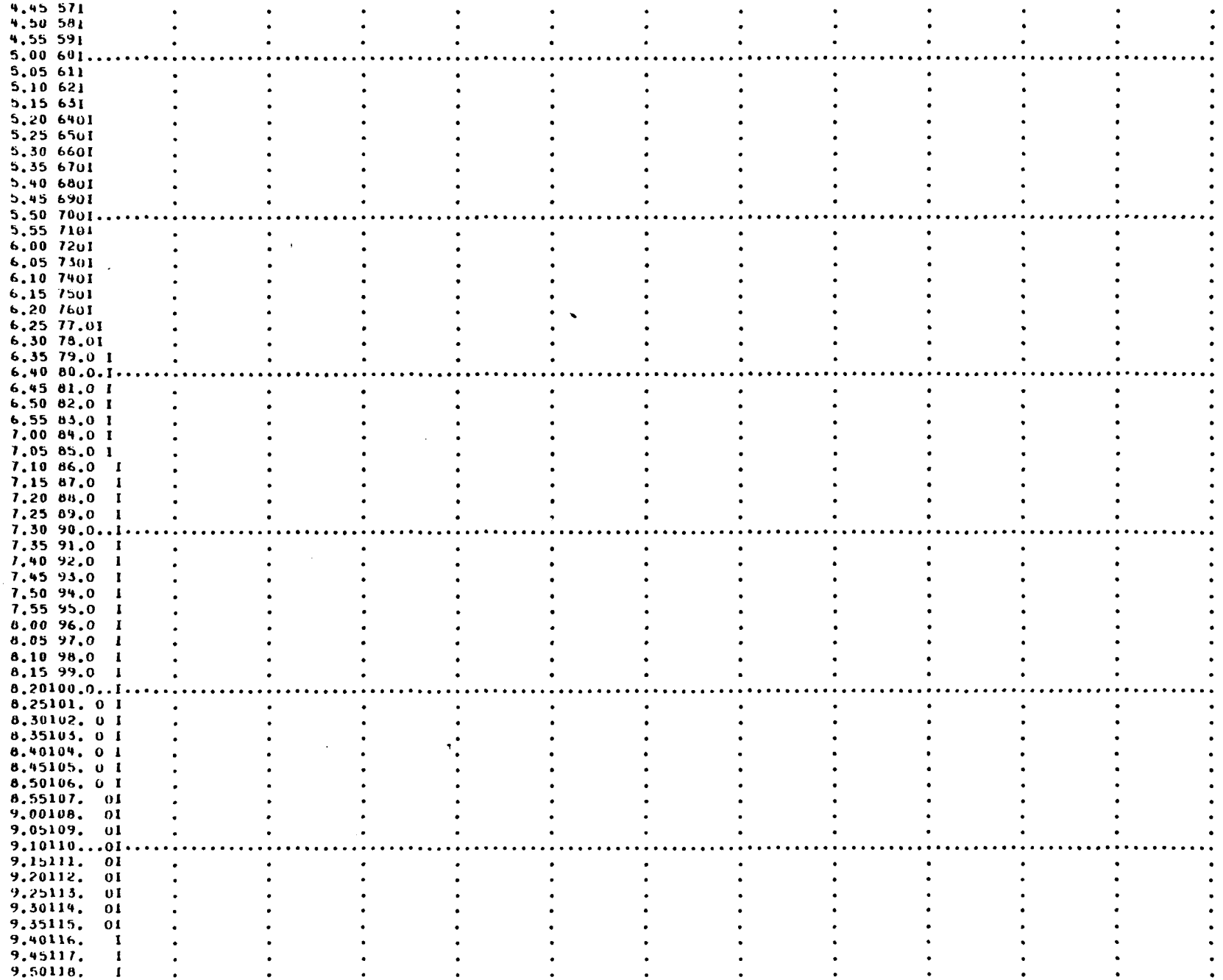
4.20	521												
4.25	531												
4.30	541												
4.35	551												
4.40	561												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5.30 66OI
5.35 67OI
5.40 68OI
5.45 69OI
5.50 70OI
5.55 71OI
6.00 72OI
6.05 73OI
6.10 74OI
6.15 75OI
6.20 76OI
6.25 77.0I
6.30 78.0I
6.35 79.0 I
6.40 80.0.I
6.45 81.0 I
6.50 82.0 I
6.55 83.0 I
7.00 84.0 I
7.05 85.0 I
7.10 86.0 I
7.15 87.0 I
7.20 88.0 I
7.25 89.0 I
7.30 90.0..I
7.35 91.0 I
7.40 92.0 I
7.45 93.0 I
7.50 94.0 I
7.55 95.0 I
8.00 96.0 I
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PLATE D-23

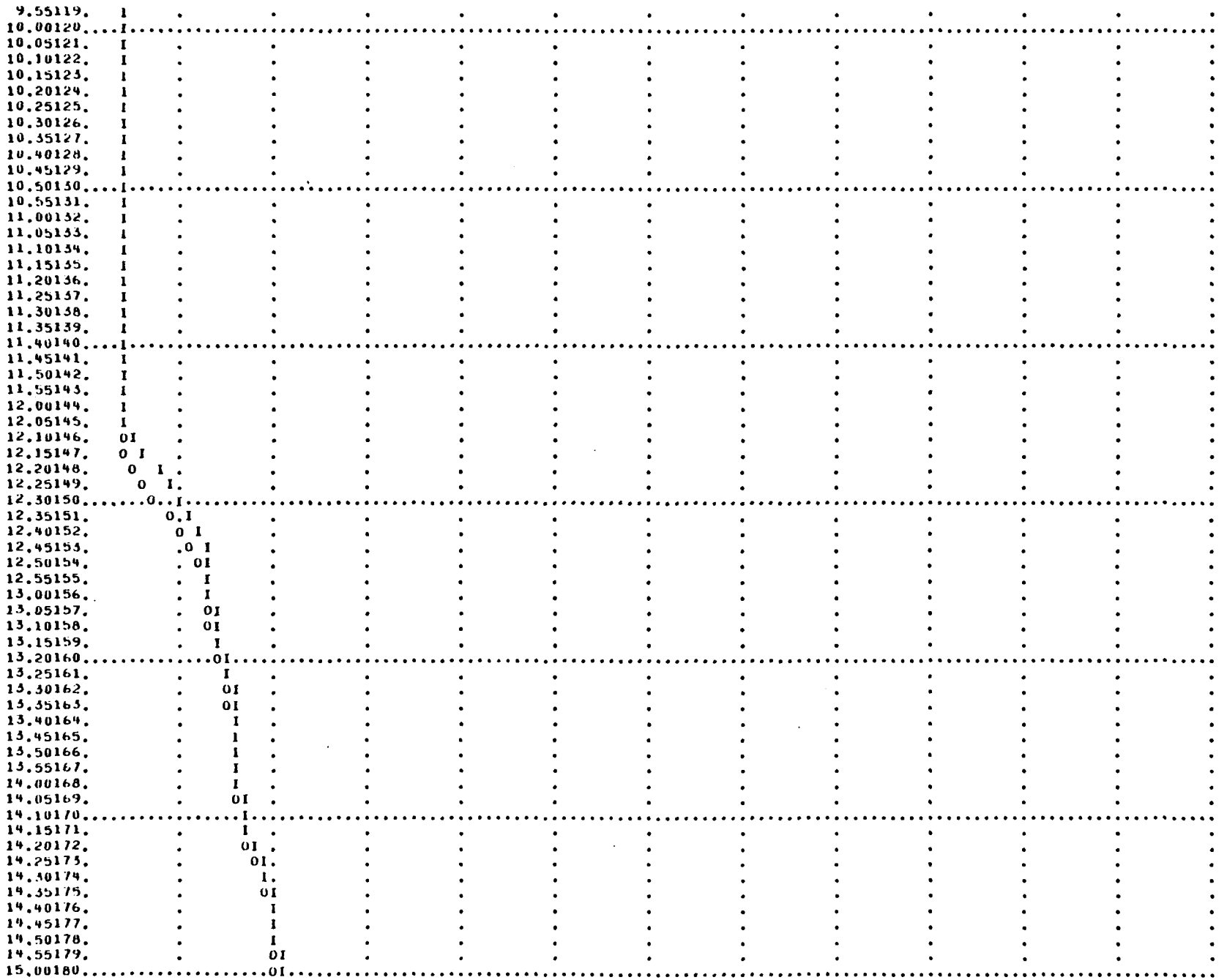
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PLATE D-24

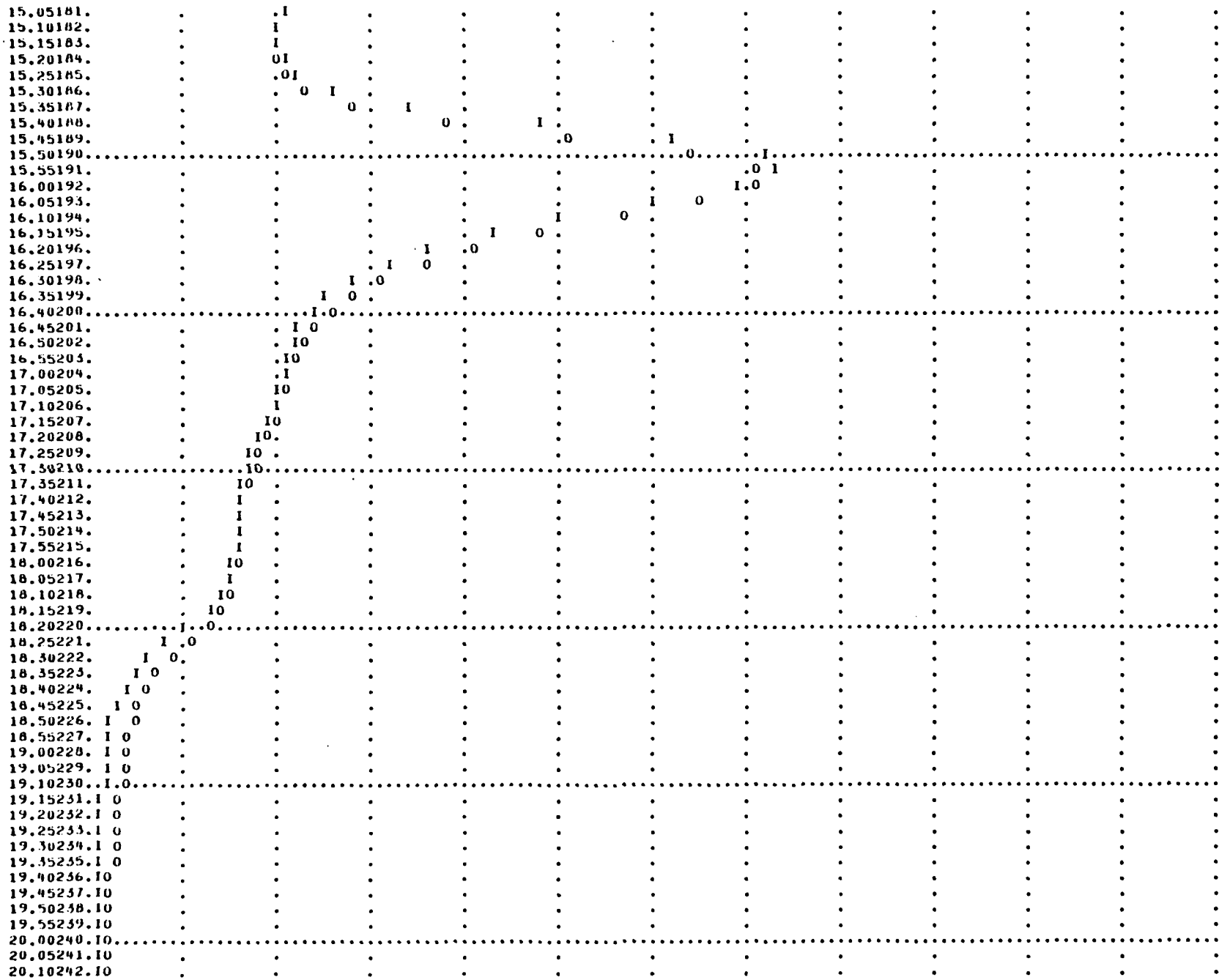
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PLATE D-25

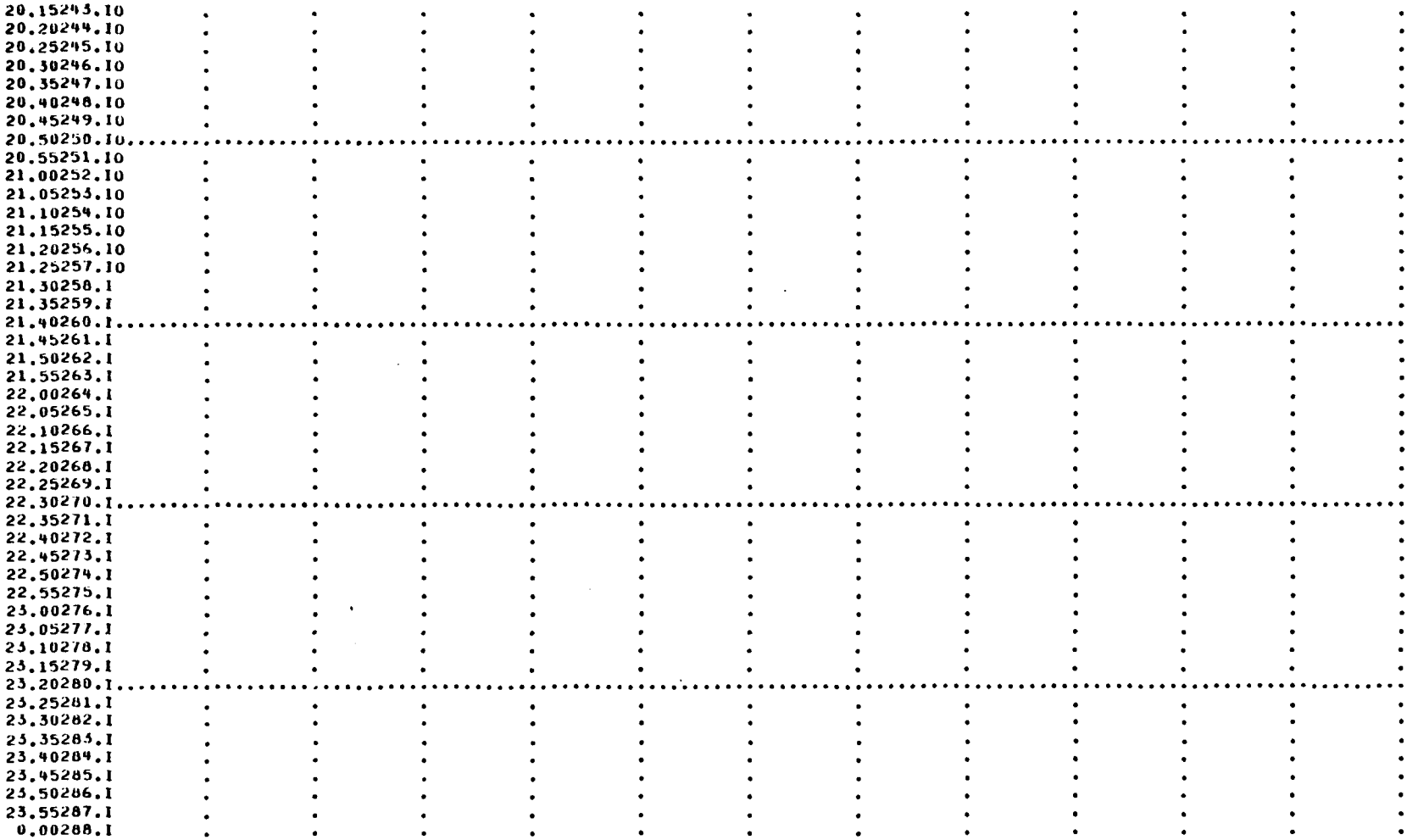
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PLATE D-26

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 .10	RATIO 2 .15	RATIO 3 .20	RATIO 4 .30	RATIO 5 .40	RATIO 6 .50	RATIO 7 .75	RATIO 8 1.00
HYDROGRAPH AT	000001	.87	1	732.	1098.	1464.	2197.	2929.	3661.	5492.	7322.
	(	2.25)	(	20.73)(	31.10)(	41.47)(	62.20)(	82.94)(	103.67)(	155.51)(	207.35)(
ROUTED TO	000002	.87	1	268.	752.	1299.	2089.	2813.	3529.	5313.	7109.
	(	2.25)	(	7.60)(	21.29)(	36.79)(	59.16)(	79.66)(	99.94)(	150.44)(	201.30)(

PLATE D-27

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	893.60	893.60	899.50
STORAGE	80.	80.	149.
OUTFLOW	0.	0.	397.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.10	898.97	0.00	141.	268.	0.00	16.50	0.00
.15	900.13	.63	158.	752.	1.25	16.17	0.00
.20	900.49	.99	163.	1299.	2.00	16.00	0.00
.30	900.88	1.38	169.	2089.	4.25	16.00	0.00
.40	901.18	1.68	174.	2813.	5.33	16.00	0.00
.50	901.44	1.94	178.	3529.	5.92	16.00	0.00
.75	902.02	2.52	188.	5313.	6.50	16.00	0.00
1.00	902.54	3.04	197.	7109.	8.50	15.92	0.00

PLATE D-28